CATALOGUE

OF THE

SCHOOL OF MINES

OF

COLORADO.

1900-1901.

STATE SCHOOL OF MINES. EAST FRONT OF MAIN BUILDINGS

1880. 1882. 1890.

CALENDAR.

1900-1901.

First Term Begins Sept. 17, 1900, Ends Feb. 6, 1901.
(Christmas Holidays, Dec. 22-Jan. 2. Inclusive.)
Second Term Begins Feb. 11, 1901, Ends June 12, 1901.
Commencement, June 13, 1901.

1901-1902,

EXAMINATIONS FOR ADMISSION.

June 14, 15, 1901. Sept. 12, 13, 14, 1901.

First Term Begins Sept. 16, 1901, Ends Feb. 5, 1902.
(Christmas Holidays, Dec. 21-Jan. 2, Inclusive.)
Second Term Begins Feb. 10, 1902, Ends June 11, 1902.
Commencement, June 12, 1902.

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Professors Chauvenet, Patton, Stockton.

COMMITTEE ON BUILDINGS AND EQUIPMENT.
Professors Curtis, Hill, Comstock.

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Curator of Apparatus.

ARTHUR B. TRIPP, Engineer.

WILLIAM H. BENNETT, JOHN AHLSTROM,
Janitors.

STUDENTS, 1900-1901.

SENIORS.

Atwater, Maxwell W.....Syracuse, New York.

Bishop, Raymond.....Denver, Colorado.

Bowman, Frank C.....Saint Charles, Illinois.

Bradley, Joseph M.....Canon City, Colorado.

Breed, Charles Francis.....Freeport, Illinois.
(B. S., University of Chicago.)

Brinker, Arthur C.....Denver, Colorado.

Bruce, James L.....Cripple Creek, Colorado.

Bumsted, Edward J.....San Francisco, California.

Burlingame, Walter E.....Denver, Colorado.

Chandler, John Winthrop, Jr. San Francisco, California.

Clark, George B.....Denver, Colorado.

Collins, Shrive B.....Del Norte, Colorado.

Crow, Wade L.....Pueblo, Colorado.

DeCou, Ralph Ernest.....Canon City, Colorado.

Downer, Roger H.....Ouray, Colorado.

Ehle, Mark, Jr.....Marshalltown, Iowa.

Frank, Harry L.....Antonito, Colorado.

SENIORS—Continued.

Harris, Willard F.....Racine, Wisconsin.
(B. S., Amherst.)

Jackson, Walter H.....Vienna, Illinois.

Johnson, Junius W.....Denver, Colorado.

Lewis, Frank E.....Denver, Colorado.

Lovering, Ira G.....Denver, Colorado.

Lucy, Frank Allen.....Denver, Colorado.

McDaniel, Alexander K.....Denver, Colorado.

Marrs, George Oliver.....Denver, Colorado.

May, John G.....Fremont, Nebraska.

Millard, Frank W.....Golden, Colorado.

Parrish, Carl Calvin.....Leon, Iowa.

Pray, Winfred A.....Mosca, Colorado.

Sale, Andrew Jackson.....Denver, Colorado.

Scheble, Max Carl.....Hutchinson, Kansas.

Simpson, William P.....Kansas City, Kansas.

Small, Harvey B.....Dulzura, California.

Starbird, Edwin P.....Denver, Colorado.

Street, Gerald B.....Chicago, Illinois.
(S. B., Mass. Institution of Technology.)

Watson, Hugh C.....Denver, Colorado.

Williams, Fred Tuttle.....Cleveland, Ohio.

JUNIORS.

Anderson, Neil A.....Rexburg, Idaho.

Badger, Herbert E.....Timnath, Colorado.

Barclay, Isla James.....London, England.

Barron, Chauncey T.....Seattle, Washington.

Bergh, John E.....Denver, Colorado.

Bucher, John W.....Berkeley, Colorado.

Butler, G. Montague.....Lake Geneva, Wisconsin.

Charles, Lavern.....Morrison, Colorado.

Christensen, Walter.....Fremont, Nebraska.

Coghill, Will H.....Monmouth, Illinois.

Coleman, R. Prewitt.....Denver, Colorado.

Collbran, Arthur H.....Denver, Colorado.

Cox, W. Ray.....Brookfield, Missouri.

Ehrich, Walter Louis.....Colorado Springs, Colorado.
(Ph. B., Yale.)

Ellis, William W.....Denver, Colorado.

Emeis, Walter A.....Davenport, Iowa.

Estes, Frank M., Jr.....Saint Louis, Missouri.

Fair, Fred A.....Denver, Colorado.

Fitch, Frank.....Denver, Colorado.

Ickis, Harry M.....Creston, Iowa.

JUNIORS—Continued.

Innis, Homer C.....St. Paul, Minnesota.
(B. A., Hamlin University.)

Izett, Glen.....Denver, Colorado.

Lehmer, Frank W.....Omaha, Nebraska.

McCulloh, Carroll B.....Fort Assinniboine, Montana.
(C. E., Princeton.)

McElvenny, Robert F.....Denver, Colorado.

Merritt, Lucien.....Duluth, Minnesota.
B., Hamlin University.)

Montrose, James F.....Denver, Colorado.

Moss, Cleveland O.....Ottumwa, Iowa.

Paul, Russell B.....Denver, Colorado.

Powers, Oliver C.....Ainger, Ohio.

Reno, Horace T.....Arvada, Colorado.

Richards, John V.....Spokane, Washington.

Rowe, Charles E.....Round Rock, Texas.
(B. S., C. E., University of Colorado.)

Skinner, Edmond Norton.....Denver, Colorado.
(Ph. B., Yale.)

Steel, J. Marshall.....Portland, Oregon.

Storm, Lynn W.....Denver, Colorado.

Taggart, George K.....Dallas, Texas.

Thomson, Francis A.....Victoria, British Columbia.

Watts, Alfred C.....Newark, New Jersey.

SOPHOMORES.

Adams, Charles.....Denver, Colorado.
Aicher, Charles P.....Denver, Colorado.
Anderson, Glenn.....White Sulphur Springs, Mont.
Bale, Bruce Buford .....Colorado Springs, Colorado.
Becker, Peter J.....Denver, Colorado.
Boley, William A.....Deadwood, South Dakota.
Brown, Walter Shirlaw.....Victor, Colorado.
(A. B., Leland Stanford.)
Carney, Hugh James.....Ouray, Colorado.
Collins, Francis Winfield.....Denver, Colorado.
Collins, Wales S.....Denver, Colorado.
Connor, Thomas V.....Pueblo, Colorado.
Cox, Augustus D.....Golden, Colorado.
D'Arcy, Arthur.....Denver, Colorado.
Deniston, Roscoe I.....Pueblo, Colorado.
Devinny, George Valentine...Villa Park, Colorado.
Dunkle, Fred W.....Indianapolis, Indiana.
Duval, William G.....Golden, Colorado.
Ellis, Charles W.....Golden, Colorado.
Emrich, Horace H.....Pueblo, Colorado.
Foster, George C.....Schooley, Ohio.
French, Albert Carver.....Denver, Colorado.
Fry, Louis D.....Denver, Colorado.
Funk, Walter A.....New York City.
Goodale, Stephen L.....Saco, Maine.
(Ph. B., Colorado College.)
Hallack, Charles, Jr.....Denver, Colorado.

SOPHOMORES—Continued.

Hyder, Frederick B.....Denver, Colorado.
Julihn, Carl Edward.....Montrose, Colorado.
Kilbourn, William D.....Pueblo, Colorado.
Kimball, Harlow M.....Evanston, Illinois.
King, Henry E.....Colorado Springs, Colorado.
Liddell, Charles A.....Golden, Colorado.
Liddell, T. Parker.....Golden, Colorado.
McDermut, Grace C. U.....Denver, Colorado.
Merwin, Eugene W.....Los Angeles, California.
Milliken, Frederick A.....Cripple Creek, Colorado.
Morris, Howard G.....Denver, Colorado.
Mullen, James Seely.....Denver, Colorado.
Nagel, Frank J.....Denver, Colorado.
Nagel, Henry P.....Denver, Colorado.
Palsgrove, Harry G.....Grand Junction, Colorado.
Parsons, Horace Fleet.....Wamego, Kansas.
Ramirez, Alejandro .....City of Mexico.
(Graduate, Military School of Chapultepec.)
Rhodes, William Barron.....Denver, Colorado.
Robinson, George P.....Denver, Colorado.
Sharps, Frank B.....Golden, Colorado.
Sloan, William Arthur.....Denver, Colorado.
Ward, William Field.....Denver, Colorado.
Washburn, Howard G.....Denver, Colorado.
Wattles, William C.....Denver, Colorado.
Wells, Frank B.....Santa Monica, California.
Wickes, L. Webster.....Helena, Montana.
Wolf, Harry J.....Colorado Springs, Colorado.

FRESHMEN.

Abbott, James Dudley.....Denver, Colorado.
Anderson, Axel E.....Denver, Colorado.
Anderson, Julius A.....Denver, Colorado.
Armstrong, Robert A.....Denver, Colorado.
Becker, Lee.....Manitou, Colorado.
Bennett, Clifford E.....Golden, Colorado.
Bicknell, John A.....Golden, Colorado.
Blood, Raymond Frank.....Denver, Colorado.
Bosworth, Charles Roderic...Denver, Colorado.
Brooks, Herbert O.....Albuquerque, New Mexico.
Bryant, Lloyd L.....Greeley, Colorado.
Buell, Arthur Whitcomb.....Denver, Colorado.
Busey, Alfred P.....Pueblo, Colorado.
Butler, Franklin.....Des Moines, Iowa.
Carnahan, Thomas S.....Ogden, Utah.
Carpenter, Howard H.....Denver, Colorado.
Catron, John W.....Santa Fe, New Mexico.
Caypless, Willis Smith.....Denver, Colorado.
Chamberlin, William Owens..Denver, Colorado.
Chaney, Hallack Teller.....Denver, Colorado.
Chase, Frank A.....Cripple Creek, Colorado.
Clark, Dee.....Golden, Colorado.
Coffin, Roy G.....Longmont, Colorado.
Collbran, Herbert Edward....Denver, Colorado.

FRESHMEN—Continued.

Collom, Roy Edward.....Denver, Colorado.
D'Arcy, Richard L.....Denver, Colorado.
Dawson, Eugene H.....Denver, Colorado.
De Sollar, Termey Cook.....Denver, Colorado.
Dick, Andrew.....Walsenburg, Colorado.
Duling, John F.....Stonewall, Colorado.
Dunn, Hugh D.....Del Norte, Colorado.
Eagleton, Fred.....Denver, Colorado.
Fillius, Lee Linwood.....Georgetown, Colorado.
Flynn, John P., Jr.....Monterey, Mexico.
Frambach, Charles L.....Denver, Colorado.
Franck, Albert C.....Kansas City, Missouri.
Franck, Robert P.....Kansas City, Missouri.
Gittings, Charles.....Pueblo, Colorado.
Goudy, Franklin Burris.....Denver, Colorado.
Green, Willis.....Craig, Colorado.
Gulick, Ray A.....Salt Lake City, Utah.
Hallett, William Jared.....Denver, Colorado.
Hazen, Clyde F.....Golden, Colorado.
Herman, Alfred.....Pueblo, Colorado.
Hill, Frank C.....Carthage, Missouri.
Hiltz, Fred T.....Golden, Colorado.
Hosea, Ralph Gay.....Denver, Colorado.
Hunt, Thacher Rodney.....Denver, Colorado.
Hurlbut, William W.....Denver, Colorado.

FRESHMEN—Continued.

Jackson, Alvin Ross.....Golden, Colorado.
Johnson, Lafayette Garfield...Denver, Colorado.
Jones, Ewing Llewellyn.....Los Angeles, California.
Judson, Andrew V.....Denver, Colorado.
Kruse, Fred, Jr.....Central City, Colorado.
Lanagan, William Harry.....Denver, Colorado.
Larsh, Walter Stuart.....Denver, Colorado.
Lee, Wallace.....Kansas City, Missouri.
Lindsey, Landon T.....Denver, Colorado.
Lohman, Harry William.....Brooklyn, New York.
Lyneman, Ernanie John.....Denver, Colorado.
Mantor, Herbert Owen.....Salt Lake City, Utah.
Marr, Zac.....Fremont, Nebraska.
Marrs, William M.....Denver, Colorado.
Metcalf, Bradley Barlow.....Denver, Colorado.
Middlekamp, Leroy Louis....Pueblo, Colorado.
Milliken, George W.....Cripple Creek, Colorado.
Nare, George Henry.....Golden, Colorado.
Prier, Funman Delmar.....Golden, Colorado.
Rabb, Eward M., Jr.....Denver, Colorado.
*Randall, Alfred.....Florence, Colorado.
Rath, Charles Martin.....Cheyenne, Wyoming.
Rathvon, Martin J.....Florence, Colorado.
Reeve, Tracy.....Denver, Colorado.
Reinhard, Frank J.....Columbus, Ohio.
Reynolds, Oscar J.....Helena, Montana.
Rice, John Turner.....Omaha, Nebraska.
Rogers, Blake.....Florence, Colorado.

*Died Dec. 8th, 19 0.

FRESHMEN—Continued.

Ryone, Leroy Tracy.....Denver, Colorado.
Sanford, Chard.....Los Angeles, California.
Sherman, Scott H.....Denver, Colorado.
Smith, Weston Martin.....Lakewood, Colorado.
Smith, Webster Temple.....Chicago, Illinois.
Sorenson, Royal Wasson.....Golden, Colorado.
Spencer, Walter Irving.....Portland, Oregon.
Stannard, Alden.....Denver, Colorado.
Stebbins, Walter Albert.....Pueblo, Colorado.
Stevenson, F. W.....Victoria, British Columbia.
Taylor, Clyde S.....Denver, Colorado.
Tescher, Samuel.....Denver, Colorado.
Thomas, John S.....Denver, Colorado.
Tiffiany, Arthur G.....Colorado Springs, Colorado.
Tiffany, J. E.....Durango, Colorado.
Trumbull, Loyal W.....Blue Island, Illinois.
Turner, John R.....Salt Lake City, Utah.
Vaughn, Robert M.....Clearfield, Iowa.
Wackenhut, George John.....Colorado Springs, Colorado.
Wallace, Howard James.....Fort Collins, Colorado.
Wells, Benjamin T.....Pueblo, Colorado.
West, Elmer W.....Omaha, Nebraska.
West, George Cowles.....Omaha, Nebraska.
Whipple, Frank L.....Cottage Grove, Oregon.
Wood, Chapp E.....Aspen, Colorado.
Woodress, James L.....Trenton, Missouri.
Wright, William Henry.....Denver, Colorado.
Wren, Dee John.....Rawlins, Wyoming.
Youngman, A. L.....Denver, Colorado.

SUMMARY.

Seniors	37
Juniors	39
Sophomores	52
Freshmen	106
Total	234

SUMMARY BY STATES AND COUNTRIES.

Colorado	154	Idaho	2
Illinois	8	Mexico	2
California	7	Minnesota	2
Iowa	7	New Mexico	2
Missouri	7	Texas	2
Nebraska	7	Washington	2
Montana	4	Wisconsin	2
Ohio	4	Wyoming	2
Utah	4	England	1
Kansas	3	Indiana	1
New York	3	Maine	1
Oregon	3	New Jersey	1
British Columbia	2	South Dakota	1

(Colorado, sixty-five per cent.; all others, thirty-five per cent.)

ENGINEERING HALL. 1894.

HISTORY AND ORGANIZATION.

The School of Mines of the State of Colorado was established by Act of the Territorial Legislative Assembly, approved February, 9th, 1874.

Its first location was a mile south of the City of Golden, where it occupied rented property. It was seen that a better site and a building were conditions without which it could not survive.

The original appropriation of ten thousand dollars was the only one which the institution received in the first nineteen years of its existence. The building thus provided for was erected upon lots given by citizens of Golden, in 1880.

It was soon perceived that the school would receive support in the way of students far in excess of the capacity of the building erected from such an appropriation. From this time until 1894, all additions were made from current income, which for the greater part of the time was upon the basis of one-fifth of one mill of the tax valuation of the state.

No land having been granted by the state, and no special appropriation having ever been made toward equipment of any kind, the struggle for existence has always been severe. Of the two hundred thousand dollars now represented in the buildings and equipment, one hundred and sixty-five thousand has been saved out of income, and but thirty-five thousand has been given by appropriation.

In 1882 the original building was enlarged, and in 1890 a much larger building was added. The growth of the school imposed upon its trustees the alternative of fatally hampering

its efficiency on the one hand, or of meeting the demands from current income on the other.

Engineering Hall was erected in 1894, an appropriation of twenty thousand dollars having been made for it in 1893. Prior to this, the old system of special and partial courses had been abolished, and the solid progress since made may be fairly ascribed to this change.

In 1897 it became evident that the space available had again become insufficient, and a radical alteration of the largest building (1890) was carried out, a story being added, giving space for one of the finest draughting rooms in the West.

In 1900 Mr. W. S. Stratton, by his gift of twenty-five thousand dollars, has enabled the trustees to build the Assay Department, hereafter described, and to wholly reconstruct the chemical laboratories. To this fund M. Guggenheim's Sons have contributed one thousand dollars. Much of the fund remains on hand as a nucleus for the erection of a new building to be known as the "Hall of Metallurgy."

These visible additions to the material "plant" have been accompanied by successive advances in standard and method, probably greater in a relative sense than the increase in numbers or in appliances.

At the present time, applications for admission are in excess of the accommodations, and applicants are advised not to delay sending in their names. As shown on page 18, a large proportion of the students are from outside of Colorado.

The record of the graduates, as a body, is perhaps the most gratifying feature in the history of the Colorado School of Mines. Numbering at present over one hundred and seventy, and occupying, as most of them do, positions demanding skill and responsibility, they form the best evidence that the institution has its place among technical schools of the first rank.

LOCATION.

The institution is located at the City of Golden, sixteen miles from Denver, on the line of the Colorado and Southern Railroad, or a trifle over thirteen miles by the Denver, Lakewood and Golden Railroad. Trains of the former road leave Denver from the Union Station. The Denver, Lakewood and Golden leaves (by electric car) station on Arapahoe Street, Denver, between Fourteenth and Fifteenth Streets.

The altitude of Golden is five thousand seven hundred feet above sea level, or about four hundred and fifty feet higher than Denver.

The town lies close to the first foot-hills of the Rocky Mountains, but can hardly be considered as a "mountain town," though within an hour's ride, by rail, of some of the well known mining camps of the region.

No place in Colorado has a better health record than Golden. The climate is invigorating and pleasant, with open winters, and a large proportion of clear days.

The surrounding region is rich in the characteristic scenery of the Rocky Mountain region. The famous Clear Creek Canon begins at the town of Golden, and within a few miles may be found many points of view which the railroad tourist travels to see imperfectly from the car window.

Probably no locality in the United States could be found richer in geological illustrations of the formations of various ages, affording abundant opportunity for practical instruction, as well as exercise.

EXPENSES.

Tuition is free to *bona fide* residents of Colorado. Students from other states pay fifty dollars a term. All are charged with material consumed or broken.

The following are the various fees and charges:

Matriculation fee	$ 5.00
Graduation fee	5.00
Freshmen, Qualitative, chemicals, etc	20.00
Freshmen, same, deposit for apparatus	10.00
Sophomores, Quantitative Analysis, chemicals	20.00
Sophomores, same, deposit for apparatus	20.00
Sophomores, Assaying deposit	40.00
Juniors, Surveying fee	10.00
Athletic Association, annual dues	5.00
Damage fee	2.00

In "deposits" amounts are credited, student is charged with what he takes out, credited with all returned in good condition. Balance is returned to him. An additional deposit is required if the apparatus called for is excessive. Students doing special or thesis work are required to make a deposit of not less than ten dollars.

Students leaving before the end of a term are not entitled to any reduction of fees, except on account of sickness. All charges are payable in advance. Board and suitable accommodation can be obtained at from four to six dollars a week.

The expense of the school year, tuition fee excluded, need not exceed three hundred and fifty dollars. Many come under this figure by clubbing. The expense of the various trips is not included in this estimate. It does not exceed one hundred dollars for the series.

REQUIREMENTS FOR ADMISSION.

Candidates must be at least seventeen years of age. They must sustain examinations in English, Geography, Arithmetic, Algebra, Geometry and Zoology.

In Arithmetic, they must be ready in the use of decimals and of ratio and proportion.

In Algebra, the first eighteen chapters of Wentworth's "Higher" Algebra, or an equivalent.

The whole of Plane Geometry. Applicants are expected to show clear notions of the nature of geometrical reasoning. Some original work is given in each paper.

("Diploma students" often fail in Freshman Mathematics, showing that the average high school graduate is "rusty" in the elements. Such applicants are warned against the idea that "once admitted" they can hold their own in spite of neglect to revive forgotten topics.)

English of High School standard is required. An original composition (theme suggested), is assigned. Exercises are given in spelling, pronunciation (diacritical marks), and correction of phrases. No formal examination is given in Literature nor in Grammer. Lewis's "First Book in Writing English" is recommended for preparation.

In general and physical Geography (one paper), such questions only are put as should form part of the knowledge of any intelligent lad.

In Zoology, "Steele's" is recommended for preparation. Applicants not prepared in this topic are nevertheless admitted, provision being made for their instruction, though not by members of the Faculty. The fee for this course depends upon the number conditioned, and is usually about three dollars.

Applicants are warned of the great risk attending attempts at self-preparation.

Diplomas from accredited High Schools are accepted for admission to Freshman class. They must bear date not earlier than the year preceding application.

Candidates for advanced standing will be examined in all the studies of the course below the class applied for unless they can present credits sufficient, in the opinion of the Faculty, for admission without examination. *The Faculty reserves the right, however, to examine for admission to any higher standing than the first term of the Freshman year, irrespective of the credits brought from another institution.* Those whose credits for a given class are only partial, cannot be admitted to such class, unless they can also present credits for a portion of its work, thus providing time in which to make up the deficit.

It is necessary for all such applicants to bring with them the work they have executed in Mechanical Drawing, or in Descriptive Geometry.

Examinations may be taken at the homes of the applicants, papers being forwarded to some responsible examiner. This applies to Freshman admissions only.

All candidates for admission are advised to take the June examination. While a partial failure in June forfeits much of the advantage of early application, an applicant so failing still has precedence over one not presenting himself before September.

An applicant who has passed his entrance examinations, or presented an approved diploma, is put upon the "accepted" list, and so notified. But he is not "admitted" until his matriculation fee is paid. The large number of admissions, hitherto, of applicants who never appeared at the school, renders this regulation imperative. Those failing to send their matriculation fee within the specified time (due notice being sent to each one), lose all advantage of priority in application, and if they wish afterwards to enter, must take their chance for a vacancy in September.

GOLDEN HIGH SCHOOL.

WILLIAM TRIPLET, PRINCIPAL.

REGULATIONS.

Pupils admitted to the High School may pursue such studies as they are prepared to take, but fifteen (15) units of study, including History and English four (4), Algebra one and one-half (1½), and Geometry one and one-half (1½), will be required for graduation.

By "Unit of Study" is meant a year's work on any branch, five (5) recitations per week, for thirty-six (36) weeks. Seventy (70) per cent. is required as a passing grade.

The twenty (20) units of study are as follows:

I. MATHEMATICS, 4.
   - (a) Algebra, 1½.
   - (b) Geometry (Plane and Solid), 1½.
   - (c) Trigonometry, ½.
   - (d) Arithmetic, ½.

II. SCIENCE, 4.
   - (a) Physiography, 1.
   - (b) Physics, 1.
   - (c) Chemistry, 1.
   - (d) Biology, 1.

III. HISTORY AND ENGLISH, 4.

IV. LATIN, 4.

V. GERMAN, 4.

This school offers ample opportunities to those wishing to prepare for the School of Mines.

COURSES AND DEGREES.

There are two full courses of study, viz., Mining and Metallurgical Engineering, and Electrical Engineering. Each covers a period of four years. The studies, however, are identical during the first year of all courses, beginning to diverge at the opening of the second year.

The degrees given are:

Engineer of Mines and Metallurgy (E. M.)
Electrical Engineer (E. E.)

Students cannot make any variation or division in the regular course during the Freshman year. In the upper classes they may, subject in each case to approval by the Faculty, divide a year, *i. e.,* take two years time for the work of a single year. This privilege, however, is subject to the invariable condition that the mathematical studies shall be taken in the first of the two years, and the chemical or other work in the second. The Faculty also reserves the right to require the repetition in the second year of any or all of the work gone over in the first year.

No special or partial students are admitted, except as Post Graduates.

There are no special *courses.* Post Graduate students attend lectures or practical work with regular classes, and are "specials" only in the sense that they may omit certain lines, and are not confined to the course of any one class.

Fire assaying is excluded from these special or partial post graduate courses, unless the student is a candidate for a degree, and is taking all the other work required.

EXAMINATIONS AND CONDITIONS.

Regular examinations, which all students are required to attend, are held at the end of each term, on the various subjects pursued during the term. Upon the completion of any branch of study, the student will be subjected to a rigid examination upon the whole subject.

Absence from examinations, whether from illness or from any other cause, can be excused only upon presentation of satisfactory reasons to the President of the Faculty.

No student can present himself for examination in any subject who has not attended at least eighty per cent. of the lectures or other exercises on that subject.

Students failing to attend examinations for the removal of conditions cannot be re-examined, but must repeat the year.

A condition incurred during the first term may be removed by a first re-examination, held before the end of the second term, at a regular date set for that purpose, and in case of failure to pass, by a second re-examination, held in September at a regular date set for that purpose, before the beginning of the term, and until so removed, the said condition shall remain in effect.

A condition incurred during the second term may be removed by a first re-examination, held at a regular date set for that purpose, before the opening of the school in September, and in case of failure to pass, by a second re-examination, held before the end of the first term of the next school year, at a regular date set for that purpose, and until so removed, said condition shall remain in effect.

The passing mark on all re-examinations shall be five units higher than that upon the first examination.

Any student having at the end of a term more than two conditions, shall be relegated to the next lower class.

A complete failure in any subject may relegate a student to the next lower class.

(a) A failure to pass a second re-examination shall constitute a complete failure.

(b) An average mark of forty or less on the whole work in any subject shall constitute a complete failure.

(c) The absence of any student from twenty per cent. or more of the prescribed work in any subject shall constitute a complete failure.

No student may enter the Sophomore or Junior class with more than one condition.

No student may enter the Senior class with any condition.

Any member of the Senior class not in full standing in every subject at the time of the regular meeting of the Faculty in April shall be debarred from graduation.

When any prescribed trip is undertaken, having a practical bearing on the work of any course, the students in that course, and working for a degree to which that course is essential, shall be required to attend such trip, unless excused by a vote of the Faculty.

The attempt of any student to present as his own the work of another, or to pass any examination by improper means, will render him liable to expulsion.

All instruments belonging to the school are intended solely for use in class instruction, and will not be loaned to students or others. This regulation holds during vacation as well as in the active school terms.

THESES AND GRADUATION.

A thesis upon some practical subject is an important prerequisite to graduation.

Part of the work consists in visiting mines, smelteries, power plants and other works where the processes lectured upon may be seen in actual operation. Short trips of this description are frequent, while once a year a longer one is arranged, usually to some noted mining section.

Expeditions of this kind afford abundant opportunities for the student to collect materials suitable for memoirs and theses.

All memoirs, theses and drawings which constitute a regular part of the school work, may be retained by the institution, and preserved as a part of the permanent record of the student who executed them.

Each Senior shall submit to the Faculty, not later than November 1st, the subject of his thesis, which subject must be approved by the proper Professor. Each thesis must be type-written or printed, on 10¼x8-inch paper, and bound in book form.

The completed theses must be handed in not later than June 1st.

Theses must be completed in final form, and handed to the librarian, before the delivery of diplomas. No diploma will be delivered until this requirement has been met.

No student shall be allowed to graduate while indebted to the school.

SCHEDULE OF STUDIES.

FRESHMAN YEAR.

FOR ALL COURSES.

FIRST TERM.

Algebra	5 hours a week.
Geometry	3 hours a week.
General Chemistry	4 hours a week.
Descriptive Geometry	2 hours a week.
Drawing	15 hours a week.

SECOND TERM.

Trigonometry	3 hours a week.
Algebra	5 hours a week.
General Chemistry	4 hours a week.
Descriptive Geometry	2 hours a week.
Drawing	6 hours a week.
Qualitative Analysis	12 hours a week.

COURSE IN MINING AND METALLURGY.

SOPHOMORE YEAR.

FIRST TERM.

Calculus	3 hours a week.
Analytical Geometry	2 hours a week.
Mineralogy	5 hours a week.
Physics	4 hours a week.
Physical Laboratory	2 hours a week.
Mechanism	1 hour a week.
Quantitative Analysis	12 hours a week.
Mechanical Drawing	4 hours a week.
Chemical Analysis (Lectures)	1 hour a week.

SECOND TERM.

Calculus	3 hours a week.
Analytical Geometry	2 hours a week.
Mineralogy	10 hours a week.
Physics	4 hours a week.
Physical Laboratory	2 hours a week.
Volumetric Analysis and Fire Assaying	8 hours a week.
Drawing	3 hours a week.
Mechanism	1 hour a week.

COURSE IN MINING AND METALLURGY.

JUNIOR YEAR.

FIRST TERM.

Geology.....4 hours a week.
Mechanics.....3 hours a week.
Surveying.....3 hours a week.
Surveying (Field Work).....9 hours a week.
Metallurgy.....3 hours a week.
Machine Design.....2 hours a week.
Machine Design (Drawing).....6 hours a week.

SECOND TERM.

Geology.....3 hours a week.
Mechanics.....3 hours a week.
Metallurgy.....3 hours a week.
Surveying.....2 hours a week.
Surveying (Field Work).....9 hours a week.
Graphics.....2 hours a week.
Graphics (Drawing).....3 hours a week.
Machine Design.....1 hour a week.
Machine Design (Drawing).....3 hours a week.

COURSE IN MINING AND METALLURGY.

SENIOR YEAR.

FIRST TERM.

Metallurgy	4 hours a week.
Mining	5 hours a week.
Hydraulics	5 hours a week.
Theory of Construction	2 hours a week.
Mining and Metallurgical Design	6 hours a week.
Hydraulic Laboratory	2 hours a week.
Theoretical Chemistry	1 hour a week.
Testing Laboratory	2 hours a week.

SECOND TERM.

Metallurgy	4 hours a week.
Mining	5 hours a week.
Power Transmission	5 hours a week.
Technical Chemistry	1 hour a week.
Steam Engine Laboratory	2 hours a week.

COURSE IN ELECTRICAL ENGINEERING.

SOPHOMORE YEAR.

FIRST TERM.

Calculus .....3 hours a week.
Analytical Geometry .....2 hours a week.
Physics .....4 hours a week.
Physical Laboratory .....4 hours a week.
Mechanism .....2 hours a week.
Chemical Analysis (Lectures).....1 hour a week.
Quantitative Analysis.....12 hours a week.
Drawing .....6 hours a week.

SECOND TERM.

Calculus .....3 hours a week.
Analytical Geometry .....2 hours a week.
Physics .....4 hours a week.
Physical Laboratory .....4 hours a week.
Mechanism .....2 hours a week.
Drawing .....9 hours a week.
Shop Work.....6 hours a week.

COURSE IN ELECTRICAL ENGINEERING.

JUNIOR YEAR.

FIRST TERM.

Dynamo Machinery	4 hours a week.
Dynamo Laboratory	8 hours a week.
Calculus	5 hours a week.
Mechanics	3 hours a week.
Machine Design	2 hours a week.
Machine Design (Drawing)	8 hours a week.
Electrical Measurements	4 hours a week.
Differential Equations	2 hours a week.

SECOND TERM.

Dynamo Machinery	4 hours a week.
Dynamo Laboratory	8 hours a week.
Mechanics	3 hours a week.
Batteries	2 hours a week.
Precision of Measurements	2 hours a week.
Electrical Design	4 hours a week.
Electrical Measurements	10 hours a week.
Testing Laboratory	1 hour a week.

COURSE IN ELECTRICAL ENGINEERING.

SENIOR YEAR.

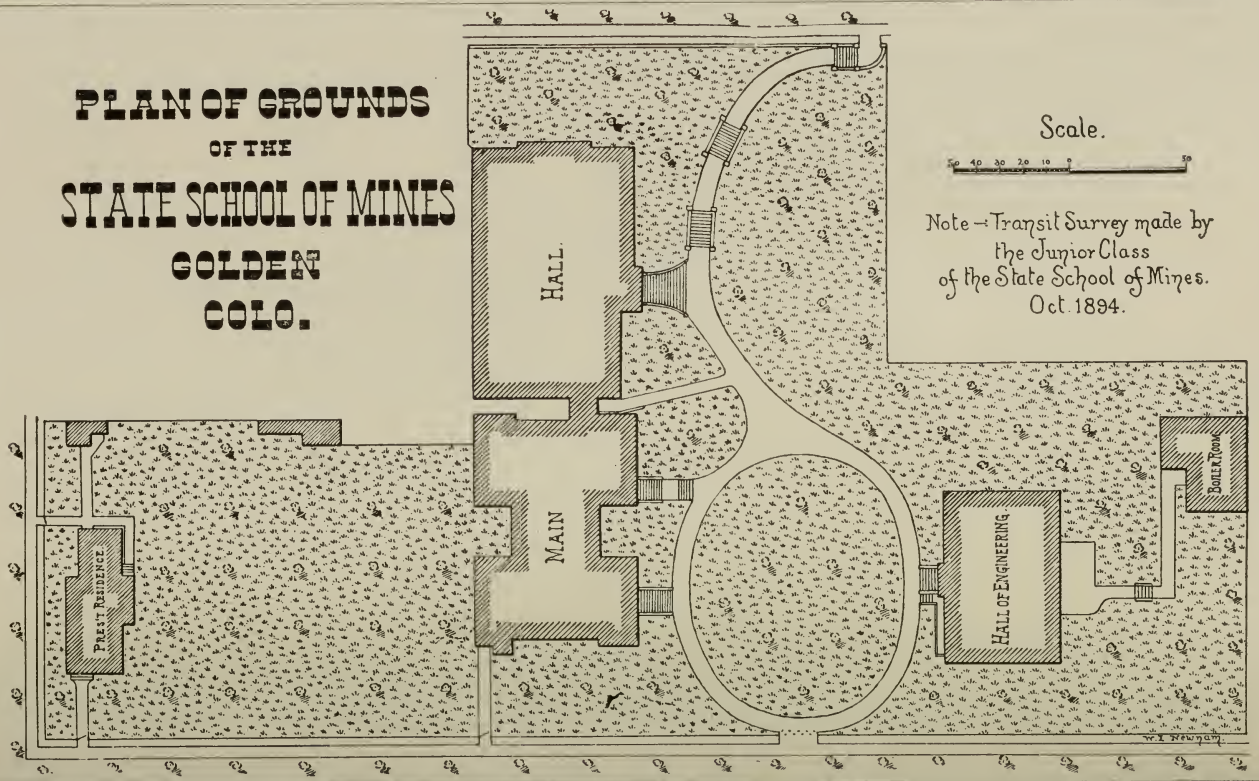
FIRST TERM.

Hydraulics	4 hours a week.
Transformers and Alternating Currents	5 hours a week.
Dynamo Laboratory	8 hours a week.
Electrical Design	6 hours a week.
Photometry and Electric Lighting	2 hours a week.
Laboratory Work in Photometry	3 hours a week.
Hydraulic Laboratory	1 hour a week.

SECOND TERM.

Power Transmission	4 hours a week.
Electrical Transmission	3 hours a week.
Steam Engine Laboratory	3 hours a week.
Electrical Design	6 hours a week.
Thesis Work	15 hours a week.

PLAN OF GROUNDS
OF THE
STATE SCHOOL OF MINES
GOLDEN
COLO.



DEPARTMENTS OF INSTRUCTION.

CHEMISTRY.

PRESIDENT CHAUVENET. PROF. HARTMAN. MR. TEST.

Much time is devoted to the study of general and analytical Chemistry. The course in general Chemistry which includes a discussion of its fundamental principles, nomenclature and the use of symbols and equations, runs through the Freshman year. It comprises four lectures weekly, fully illustrated by experiments, sixteen written "quizzes," and two general examinations.

An advanced course, dealing with historical, theoretical and applied Chemistry is given during the Senior year. In connection with these courses, the subject of stoichiometry is thoroughly taught by lectures and recitations, with numerous exercises in calculation. This work is not confined to purely chemical calculations, but includes also metallurgical and physical features, such as the metric system, specific gravity, density and tension of gases, calculation of formulae and analyses, slag calculations, and generally all applications of elementary Mathematics to chemical and metallurgical problems.

ANALYTICAL CHEMISTRY.

The courses in analytical Chemistry begin in the second term of the Freshman year, with an exhaustive course in qualitative analysis, requiring ten hours weekly, in which the reactions of all the more common elements and radicals are

INTERIOR OF ASSAY LABORATORY.

studied and their identification in mixtures of varying complexity, is taught. Identification of rare elements and spectroscopic analysis, are included in the course, which is further supplemented by lectures on principles and methods.

The study of quantitative analysis is carried on during the entire Sophomore year, seven hours weekly being required. The first term is devoted more particularly to the study of gravimetric methods, passing from the analysis of simple salts to difficult separations in minerals and alloys. The second term of the Sophomore year is devoted to the study of the rapid volumetric methods favored in the West. A large stock of checked ores of various kinds is available, and the work is made eminently practical. When time permits the study of electrolytic methods, iron and steel analysis, gas and water analysis, and other advanced work may be taken up.

The work of the chemical department has been greatly facilitated by the complete rehabilitatiton of the laboratories. They are equipped with modern tile-topped desks, fitted with gas and sinks. There are also improved systems of heating and ventilation, numerous hoods, mechanical blast and suction, drying closets and other improvements, making the laboratories of the School equal to any in the United States. These laboratories occupy nearly the whole of the building of 1880-1882, and will accommodate at least one hundred and sixty students at one time. In addition to the two large laboratories, devoted to general use, there are balance rooms, private and research laboratories, and supply rooms, which meet all possible requirements.

All students in laboratory courses must, in addition to payment of desk fees make a deposit with the Registrar before receiving apparatus and supplies. In case of excessive withdrawal of apparatus a second deposit may be called for. No fee for less than an entire term's work is accepted. Students are not permitted to do any analytical work except that outlined in the regular courses, or in assigned theses, whether for fees or gratuitously. All work must be done at the suggestion and under the direction of the professor in charge.

FIRE ASSAYING.

PROF. CLERC. MR. TEST.

Through the generosity of Mr. W. S. Stratton, of Colorado Springs, the Board of Trustees has just completed the largest laboratory for fire assaying of any institution in the United States. The building is 92 by 46 feet, having thirty-two muffle furnaces with space for sixteen more, well equipped parting room, balance rooms, office and store room. Each student has his own muffle, coal bin, and desk room conveniently arranged with regard to his furnace.

Fire assaying is taken up by sections running through the Sophomore year. The principles of fluxing are first taught, followed by their application to typical ores, siliceous, barytic and pyritic. The course involves thorough work in the assay of rich, medium and low grade ores of lead, gold and silver. The nitre, nail and roasting methods are required, and the results compared. The course includes also copper mattes, bullion by scorification, and combined wet and dry methods; silver bullion by wet and fire methods; and gold bullion.

Large numbers of checked samples are given to students, and it is believed that no technical school in the country exacts such an amount of actual practice as is here insisted upon, before the student is pronounced fit for a practical assayer. No term passes without applications to the institution for assayers or chemists. Nearly every large reduction works in the region has one or more of our graduates in its employ.

The department desires to acknowledge courtesies and gifts of samples from the O. & G. S. and R. Co.; E. E. Burlingame, of Denver; The State O. S. Co., of Black Hawk; the Pueblo S. & R. Co., and Colo. Sm. Co.; the Bi-Metallic and Ark. V., of Leadville; Taylor and Brunton Sampling Works; Aspen mine, and Arequa Mill of Cripple Creek.

METALLURGY.

PROF. CLERC. PREST. CHAUVENET.

The study of Metallurgy begins with the Junior year, and continues throughout the remainder of the school course. The subject is taught by illustrated lectures, study of text-books, and visits to metallurgical works, where the students see and study the operations described in the class room.

JUNIOR YEAR.

General Principles of Metallurgy—Historical sketch. The relations of Chemistry to Metallurgy. Properties of the metals. Alloys, brasses and bronzes. Thermo treatment of metals.

Fuels (solid, liquid and gaseous), their occurrence, manufacture and uses.

Refractory materials, their occurrence, properties, manufacture and uses.

Furnaces, different types used for various metallurgical operations. Blowing apparatus. Hot-blast stoves.

Fluxes, including the study of slags and calculation of furnace charges. Typical metallurgical processes.

Sampling of Ores and Metallurgical Products.

Roasting of Gold, Silver, Copper, Lead, Zinc and Iron Ores.

Metallurgy of Iron and Steel—The ores of iron and their impurities. The metals, iron and steel, their chemical and mechanical properties, as affected by process of manufac-

ture or by impurities. The blast furnace. Manufacture of steel by the Bessemer process and its modifications.

Copper Smelting and Refining—Smelting in reverberatory and blast furnaces.

Pyritic smelting.

Refining of mattes by various processes.

Electrolytic refining.

Metallurgy of Lead—Smelting in reverberatory furnaces, in the American ore hearth, and in blast furnaces. The desilverization of base bullion. Cupellation.

SENIOR YEAR.

Metallurgy of Gold—Occurrence and properties. General discussion of various processes for extraction from ores.

Extraction by amalgamation. Arrangement of plant, and description of typical mills.

Chlorination process.

Cyanide process.

Melting and refining of gold, and parting of gold and dore bullion.

Metallurgy of Silver—Occurrence and properties. General discussion of various processes for extraction from ores.

The Patio process. The pan amalgamation process. The combination process. Chloridizing, roasting and pan amalgamation.

The Boss process. Wet processes. Refining silver bullion.

Metallurgy of Zinc, Tin, Aluminum, Mercury, Antimony and Platinum.

Purchasing and Testing of Ores—A series of lectures is given, followed by practical work in the laboratory. (See "Graduation Theses.")

Graduating Theses—Students who choose a metallurgical subject for their graduation thesis are given a typical ore of gold, silver, lead or copper, which they test, and determine the most profitable method of treatment to be adopted under the given commercial conditions. The student having selected a method of treatment, then prepares working drawings and specifications for a plant to treat the given ore. The drawings, specifications, and a summary of the tests constitute the thesis necessary for graduation.

This course is given by lectures abundantly illustrated by lantern slides and supplemented by visits to the iron, lead and copper smelting works of Pueblo; lead and copper smelters of Denver and Leadville; cyanide plants of the Cripple Creek district, zinc works at Canon City, and various concentration and sampling works throughout the State. The text-books and books of reference used in this course are:

"Introduction to Metallurgy".... Roberts-Austen.
"Modern Copper Smelting"..... E. D. Peters, Jr.
"Metallurgy of Lead"..... H. O. Hofman.
"Metallurgy of Gold"..... T. K. Rose.
"Metallurgy of Silver"..... Eissler.
"Metallurgy of Silver"..... Eggleston.

In addition to these regular texts, numerous references are made to current technical literature.

MINING AND METALLURGICAL EXCURSIONS.

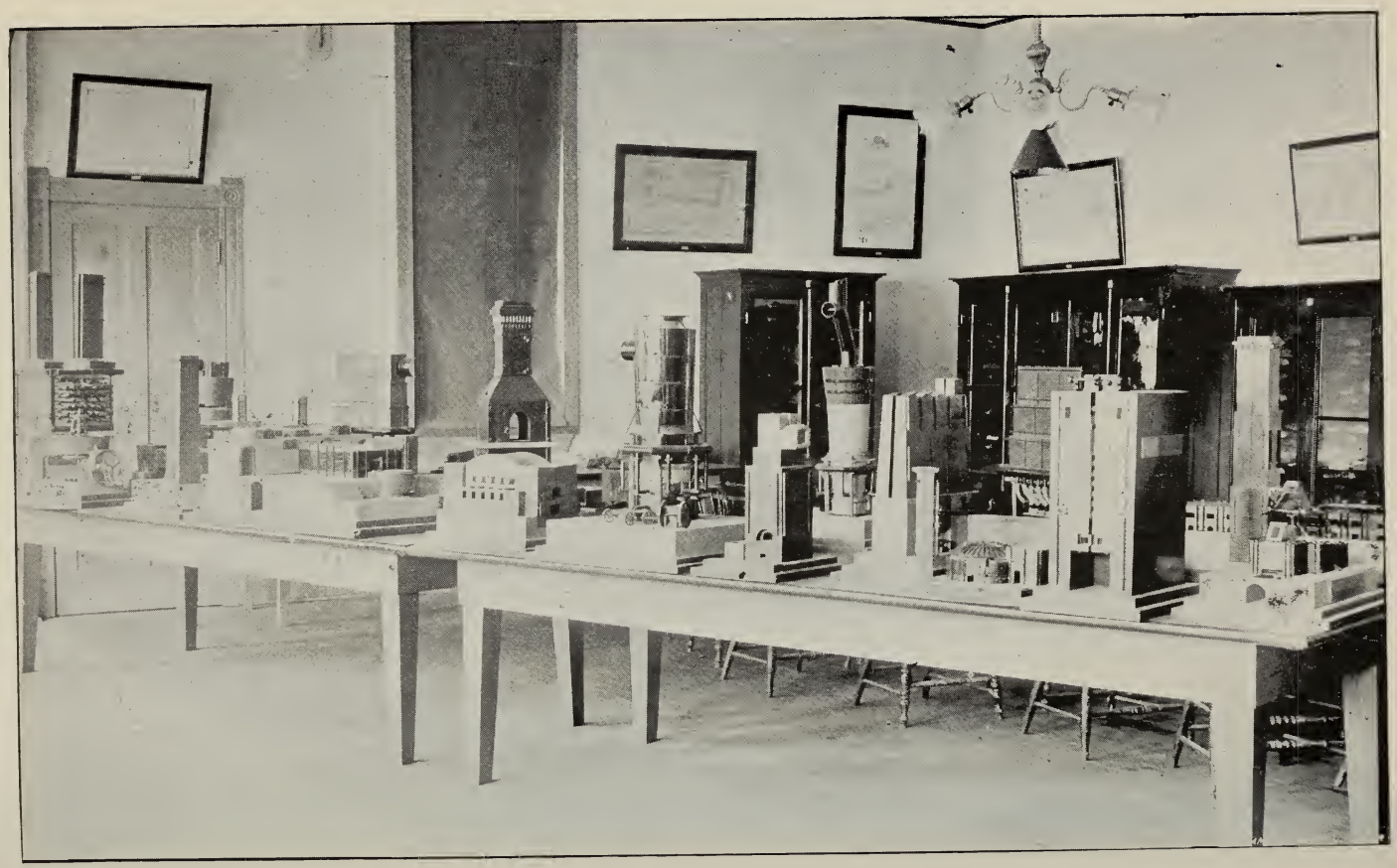
Visits to local mines and metallurgical plants are of weekly occurrence during the last two years of the course. In addition to these the Senior class makes two excursions to more distant plants. The first of these takes place in the fall just previous to the opening of the school year, and the second shortly before commencement. *These trips are required of all Senior candidates for the Mining and Metallurgical degree.*

The graduating class of 1900 devoted two weeks to the spring trip, visiting the lead smelters and steel works at Pueblo, the coal mines and washeries and the coke ovens at El Moro, Starkville and Walsenburg, and the gold and silver mines and mills of the Telluride and Ouray districts.

During the fall the class of 1901 visited the chlorination mill at Colorado City, and the iron and lead smelters at Pueblo. On these trips the students are accompanied by two or more professors, and the visits are carefully scheduled. The inspection of the various works is accompanied by lectures on the ground, by the professors in charge.

Many students work during the summer months in mines or mills. Though this is no part of the course, students in the upper classes are urged to avail themselves of these opportunities.

The institution is greatly indebted for facilities furnished by Mr. Frank Trumbull, President of the Colorado & Southern Railroad, the transportation between Denver and Leadville having been a free gift to the school.



GROUP OF METALLURGICAL MODELS.

METALLURGICAL MODELS AND MATERIALS.

The school has the advantage of a remarkable collection of models from the workshop of Theodore Gersdorf, Freiberg, Saxony, illustrating the principal types of furnaces in this country and Europe. Each model is made to a scale and is complete in every detail. The following furnaces are represented:

Long hearth roasting furnace, for silver, lead and copper ores.

American lead-silver furnace, as used in Colorado smelters.

Round silver-lead furnace, as used in Germany.

Small round silver-lead furnace, of type used with scant water supply.

Complete "plant" for refining "base bullion," including the following models:

Softening furnace in Parks' process, as used at Pueblo, Kansas City, St. Louis, etc.

Zinc pots as used in same.

Sweating furnace as used in same.

Lead pots as used in same.

Concentration cupel for making silver bullion.

Belgian zinc furnace, as used in Missouri, New Jersey and Belgium.

Silesian zinc furnace, as used in parts of Europe.

Silver amalgamation pan (working model), as used in United States.

Copper reverberatory furnace, as used in Montana, Colorado, etc.

Gerstenhofer roasting furnace, for fine copper and iron sulphides.

Tin blast furnace, as used in Saxony.

Bismuth smelting furnace, as used in Germany.

Large mercury furnace, as used in Almaden, Spain.

Fume furnace, for making lead and zinc paints.

A handsome addition to these models is due to the liberality of Mr. John W. Nesmith, President of the Colorado Iron Works. It includes:

1. Working model of twenty-stamp mill, on scale of one and one-half inches to the foot.

2. Working model of ore rolls, same scale.

3. Working model of a Dodge crusher.

4. Model of modern blast furnace for lead-silver ores, with water jacket.

In addition to the above there is a large number of smaller models, being the complete set used in the famous Keys and Arents lead-well suit.

In Colorado students have unusual opportunities for the practical study of metallurgical operations on a large scale. Denver is not only the mining center of the United States, but the business of treating silver and gold ores by lead smelting is carried on by large plants in Denver and Pueblo, on a scale unequaled in any other part of the world.

In the State, within easy reach of students, metallurgical and mining work of every description is in active operation.

Coal mining, coke and charcoal manufacture.

Brick and tile works.

Iron blast furnaces, and Bessemer steel works.

Gold, silver and lead mining, gold placer mining, smelting processes of all kinds. Gold mining, concentration milling, silver chloridizing, lixiviation milling, wet processes for gold, ore sampling works, iron foundries and machine shops, with manufacturing establishments in great variety.

The lectures throughout are richly illustrated by lantern exhibits of plans, views and designs of metallurgical works and appliances.

ORE DRESSING.

PROF. COMSTOCK.

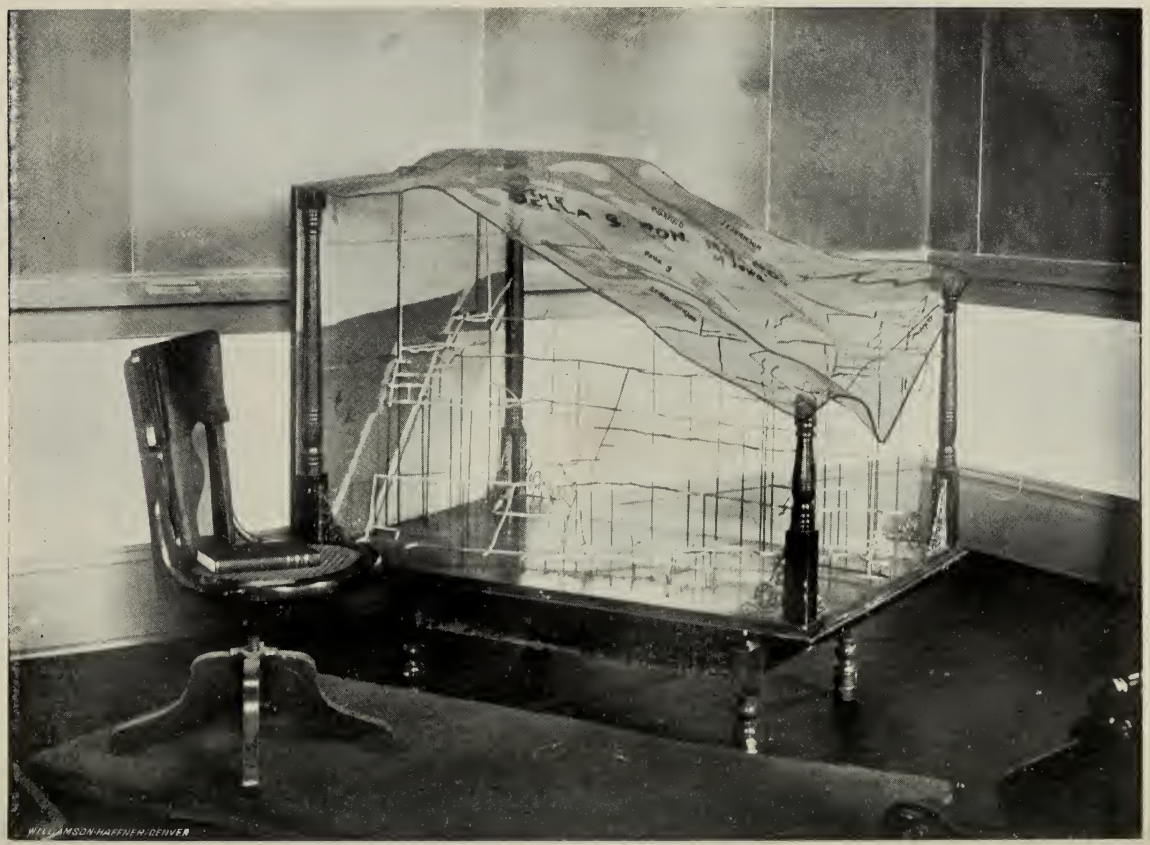
This subject comprises a study of the mechanical operations which ores undergo preparatory to metallurgical treatment. It begins with a detailed study of the relations between a solid particle and a fluid, either at rest or in motion, and the principles so developed are applied to the various concentrating devices in use. The principles involved in the different types of crushing and grinding machines are considered at some length. This work is illustrated by facts and figures collected from practice in the numerous dressing works of this region, and supplemented by visits to the mills of the immediate neighborhood of which there are many.

No text is used for the class room work. The subject is taught by lectures in which a free use is made of lantern slides, drawings and photographs. The School is also supplied with a large collection of concentration products from various mills in the State. These comprise headings, tailings and intermediate products from machines treating different sizes and classes of material, and are of great value to students in this course.

The laboratory, in which all students do some work in ore dressing, contains a crusher, a sample grinder, a Vezin laboratory jig and a Wilfley table. A motor and counter shafting are so arranged that this machinery can be run at any speed and continuously for any desired length of time.

It is believed that the course as here arranged fits the students to undertake the study of the difficult problems in concentration which every mining camp presents sooner or later and to solve many of them successfully.

The course in ore dressing is given in the Junior year.



Model of The Della S. Consolidated Mine, Aspen, Colorado.

MINING.

PROF. COMSTOCK.

This subject is taught by lectures illustrated by lantern slides, photographs and drawings. Five lectures per week are delivered during the Senior year. In addition to the class room instruction, two afternoons per week are devoted to the detailed design of a plant for the development of a mine, the ruling conditions being specified.

The outline of the course is as follows:

Ore Deposits—Their classification, modes of formation and economic study. Description of typical deposits.

Boring—Diamond drill work and the percussion methods.

Breaking Ground—Hand tools, rock drills, channellers, coal cutters, steam shovels and dredges.

Explosives—Black powder, nitro-glycerine, gun-cotton and their compounds; methods of testing and calculations of heat and pressure developed. The wave of explosion and the theory of blasting. Pointing and charging holes. Methods of firing.

Shaft-Sinking, Tunneling and Supporting Excavations—Methods of sinking and driving in loose and running ground. Linings of wood, metal and masonry, their relative strength, cost and durability. Timbering of stopes and other working places and preservation of timber.

Exploitation—Systems of mining in beds and veins. Descriptions of the special methods adopted for working bodies of soft ore and large masses.

Transportation—Underground and surface. Vehicles and motive powers. Self-acting and engine planes and haulage by the tail rope and continuous rope systems. Electric haulage. Surface tramways and aerial ropeways.

Hoisting—Receptacles, ropes, gallows frames and motive powers. Safety appliances. Pneumatic hoisting.

Drainage—Sources of mine water. Dams and drianage levels. Hoisting water. Direct acting and Cornish pumps. Pumping by compressed air and electricity.

Ventilation and Lighting—Natural ventilation. Friction of air in mines. Furnaces and fans. Efficiency of ventilating apparatus. Candles, open lights, safety lamps and the electric light.

Ascent and Descent—Ladders. Buckets and cages. Man engines. Time required and consideration of the relative economy of the different methods.

Accidents—Surface and underground. Classification and mortality.

Administration—Business management and the principles of the employment of labor.

Mine Examination—Sampling of ore bodies, estimation of "ore in sight" and the valuation of mining properties.

Placer Mining—Pipe lines, nozzles and hydraulic elevators; their construction and use. Sluices—construction, length, grade and efficiency. Working dry placer ground with a steam shovel. River dredging. Cost and results.

Mine surveying is referred to elsewhere.

Throughout the course the economic questions involved are kept constantly in view. Estimates of cost are given whenever obtainable from reliable sources. Care is taken to impress upon the student that mining is a *business* and to be successful, must be conducted on business principles.

This department is indebted to the generosity of Mr. D. R. C. Brown, of Aspen, for two very elaborate and accurate

models showing the geological structure of the famous Aspen district and the method of developing and working the ore bodies.

One of these models is a representation on a scale of 1:400 of all the workings of the Della S. Consolidated Mining Company in Smuggler Mountain, and covers an area of about a quarter by a third of a mile. The other, on a somewhat smaller scale, consists of twenty accurate geological sections, drawn on glass, distributed over the same area. Mr. Brown has also presented to the School of Mines a series of large maps, constituting probably the most nearly perfect geological representation of the Aspen region in existence.

Mr. Frank Bulkley, Manager of the Aspen Mining and Smelting Company, has presented the department of mining with a valuable series of maps, showing the extensive workings of the properties under his control.

Through the kindness of A. Leschen & Sons, and of Broderick & Bascom, of St. Louis; the Trenton Iron Company and John A. Roebling's Sons Company, of Trenton, New Jersey, and Washburn & Moen, of Worcester, Massachusetts, the School has come into possession of a complete series of sections of all the types of wire rope now in use.

The museum of this department is supplied with a set of models, illustrating all the approved methods of mine timbering, and with a number of mine lamps showing the evolution of the modern methods of lighting. Electric blasting appliances are provided for experimental purposes and an apparatus for measuring the work developed by the decomposition of explosives has recently been constructed at the School for the use of students of the Senior class.

Foster's "Ore and Stone Mining" is used as a text.

It is to be noted that many topics, both theoretical and practical, which are not included under the head of "Mining" in the school courses, have in fact their immediate application in practical mining. It would be an entirely misleading idea to suppose that only the Senior hours scheduled under "Mining" are devoted to that topic.

MATHEMATICS.

PROF. STOCKTON. MR. WEISS. MR. HALDANE.

Euclidian Geometry, Algebra, Plane Trigonometry and Descriptive Geometry are pursued during the first year.

In Geometry many problems not in the text are given, especially toward the close of the course. Much stress is laid upon clear apprehension of geometric reasoning, and upon ability to apply it to original solutions.

The student is made sufficiently familiar with determinants and special algebraic methods to make extensive use of them in Analytical Geometry and Calculus, which begin in the second year.

The problem of maxima and minima of analytical functions is treated in its widest sense, and, so far as the present theory of quantics allows, both the necessary and the sufficient conditions are rigorously established in determinant form.

The course in the third and fourth years is subject to variation. It consists mainly of exercises and lectures in selected parts of Advanced Mathematics. In this way lectures on the following subjects have been delivered to students specially interested in pure mathematics:

Solution of the most general system of Algebraic Equations.

Introduction to Weirstrass' Theory of Analytic Functions.

Method of Least Squares.

Elliptic Functions.

Integration on Riemann's Surfaces.

Analytical Mechanics.

A full set of models in provided for instruction in Descriptive Geometry.

DEPARTMENT OF GEOLOGY AND MINERALOGY.

PROF. PATTON. PROF. HARTMAN.

There is probably no technical school in the United States more favorably situated for the study of Geology and Mineralogy than is the Colorado School of Mines. Located

GEOLOGICAL LECTURE ROOM.

immediately at the foot-hills west of Denver, there is ready access to an almost unsurpassed series of geological sections in which all the formations from the triassic up to the recent may be readily studied. In addition to this the crystalline schists of the archæan are to be found exposed in great variety within a mile or two of the school, and the more recent volcanic rocks may be studied in the basalt and in the andes-

itic tufas of North and South Table Mountains, which form conspicuous features in the immediate landscape.

In the coal mines, stone quarries and fire clay beds of the vicinity, there are excellent opportunities for the study of Economic Geology, while the paleontologist has a good field for study in the famous fossil leaf deposits of the cretaceous and tertiary formations to be seen almost at the very doors of the school.

A large variety of minerals may also be collected in the crystalline rocks of the neighboring foot-hills and in the cavities in the basalt flow capping both North and South Table Mountains.

In addition to these great natural advantages have been added very extensive geological and mineralogical collections which offer ample opportunities for study.

To the collections originally obtained by purchase from Ward & Howell of Rochester, New York, from J. Alden Smith (formerly State Geologist), from J. S. Randall of Georgetown, Colorado, and by gifts from various mines and individuals, has from year to year been added a large amount of material collected by the professor in charge and by others.

This department occupies four rooms, in all of which may be found portions of the various mineral and geological collections. These collections have been classified as follows:

First—A Mineral Type Collection, consisting of well characterized specimens to be used by the students for the purpose of study and comparison. This collection contains at present specimens representing two hundred and seventeen species and sixty-one additional varieties. These specimens come from many countries, but Colorado minerals are specially well represented.

Second—A Display Collection, mainly of large and fine specimens of minerals and rocks. Many graduates and mining men, friends of the institution, have contributed by gifts to this collection.

Third—A Supplementary Collection, containing the rarer and more expensive minerals not placed in one of the above mentioned collections.

Fourth—A Descriptive Collection, illustrative of the terms used in describing the various structural, physical, optical and other properties of minerals.

Fifth—A Student's Working Collection of Minerals, consisting of over thirty thousand unlabled specimens, similar to those in the Type Collection, to be used by the student for study and determination.

Sixth—A Crystal Collection, consisting of natural crystals to be used in the determination of crystal forms.

Seventh—A Crystal Model Collection, containing a large number of glass and wooden models used in the study of Crystallography.

Eighth—A Blow-Pipe Collection, containing materials used in Blow-Piping.

Ninth—Rock Type Collection, containing (*a*) a collection of rocks from different countries of the world; (*b*) a series of Colorado rocks; (*c*) various rocks illustrative of structural features.

Tenth—A Rock Working Collection, containing miscellaneous unlabeled rocks, to be used by students in connection with the study of Lithology.

Eleventh—A Collection of Fossils, to be used in connection with the course in Historical Geology.

Twelfth—The United States Geological Survey educational series of rocks.

Thirteenth—Professor Patton's private collection of Minerals, displayed in the Faculty room.

Fourteenth—Professor Patton's private collection of rocks.

MUSEUM.

As is necessarily the case in a technical school, most of the collections are arranged for purposes of instruction. Such material is to be found in the numerous cases of drawers lining the sides of the rooms. The material of greatest interest to the visitor is to be found in the flat-top glass cases. This consists mainly of minerals, but in part also of Colorado fossils. The institution has at various times been presented with specimens of ore and minerals by graduates and friends. Many of these have been included in the "Type" Collection, but numbers are to be found in the museum, which has grown more rapidly during the past four years than at any previous time. The additions within the past two years include over seven hundred crystals, for the Crystal Collection, and a mass of material, estimated at over ten thousand specimens, now incorporated in the various collections, mainly in the "Working Collection."

Among the more interesting displays are quartz and microcline crystals from Florissant, Colorado; telluride gold and silver specimens from Boulder County, Colorado; beautiful golden calcites from Joplin, Missouri; the set of crystallized sulphur specimens; and many curious ores of various metals, chiefly gifts of mining friends. Above all, however, the cases of zeolites (thomsonite, mesolite, analcite, natrolite, etc.) from North Table Mountain, Golden, deserve attention. Probably no mesolites have ever been found so unique and so beautiful as are some of these specimens.

During the past summer a very large amount of material has been collected which will be used partly for exchange and partly for incorporation in the School collections. This new material has not been included in the list to be found on page 59, as it could not be distributed in time for this issue of the catalogue.

COURSE IN GEOLOGY.

This course runs through the Junior year and is divided into four subjects, namely: Dynamical Geology, Structural Geology, Lithology, Historical Geology. The general principles of Geology are taught through text-book (Le Conte's Elements of Geology) and lectures, supplemented by numerous field excursions.

The Rock Type Collection, Rock Working Collection, and the other collections named on pages 52 and 53, come into constant use during this course, whose intent is to make of Geology a study of practical application in connection with mining and prospecting.

The surroundings are peculiarly adapted to further this intent. The vicinity of Golden is rich in rocks of various ages, including also many illustrations of Economic Geology. Building stone, clay, limestone and coal are mined or quarried within sight of the School, while the formations include the tertiary, cretaceous, jura-trias, archæan and eruptive rocks.

The excellent and constantly growing collections of rocks make it possible to familiarize the student with all the important rock types and to make the study of Lithology a thoroughly practical one. Numerous sections of Colorado rocks have been prepared and mounted for microscopical examination.

COURSE IN MINERALOGY.

Under this head are included Crystallography, Blow-Piping and Determinative Mineralogy.

The immediate object of this course is to give the student, in a comparatively short time, a thorough familiarity with the more commonly occurring minerals, *i. e.,* with such as form the materials of rocks, or are likely to be met with in connection with mining operations.

It is quite possible so to train the powers of observation that, with the aid of a knife, pocket lens and, perhaps, of one or two other simple accessories, which can easily be carried in the pocket, one can determine on the spot nine-tenths of the minerals he meets. In the study of minerals, therefore, attention is directed mainly to the physical properties, namely, to those that can be recognized by the aid of sight and touch.

The course in Mineralogy extends throughout the whole of the Sophomore year, five hours a week being devoted to this subject the first term, and eleven hours the second term. The course opens with the study of Crystallography, which requires two-thirds of the first term. The remaining weeks of the term are devoted mainly to a short course in the use of the blow-pipe, in which only such reactions are studied as are likely to be made use of in determining minerals later in the year. Determinative Mineralogy is taken up about February 1st and extends throughout the rest of the school year.

Crystallography and Blow-Piping are taught by means of lectures and practical laboratory work. In Determinative Mineralogy, lectures are made to supplement the text-book used (Moses' and Parsons' Mineralogy, Crystallography and Blow-Pipe Analysis).

SUMMARY OF COLLECTIONS WITH NUMBER OF SPECIMENS IN EACH.

Type Collection of Minerals	3,605
Working Collection of Minerals (about)	30,000
Display Collection of Minerals	1,305
Supplementary Collection of Minerals	950
Crystal Collection	1,600
Display Collection of Fossils	342
Miscellaneous Collection of Fossils	920
Type Collection of Rocks	1,800
Working Collection of Rocks	7,168
United States Geological Survey Educational Series of Rocks	156
Professor Patton's Collection of Rocks	1,700
Professor Patton's Collection of Minerals	970
Summary of specimens	50,516

Many recent additions are not included in this summary. See last paragraph page 56.

EXCHANGES.

The School has prepared a printed list of exchange material, covering both minerals and rocks. This list will be sent to all who wish to arrange for exchanges.

Correspondents should state what material they are prepared to offer in exchange, and letters should be addressed to Prof. H. B. Patton, Golden, Colo.

PHYSICS.

PROF. HILL. MR. HAZARD.

The course in Physics is given by lectures and recitations accompanied by practical work in the laboratory. The course embraces molecular physics, gravitation, mechanics of liquids and gases, elementary machines, acoustics, the theory of heat and of the steam engine, and the general principles of light.

The second term is devoted chiefly to an elementary course in electricity and magnetism.

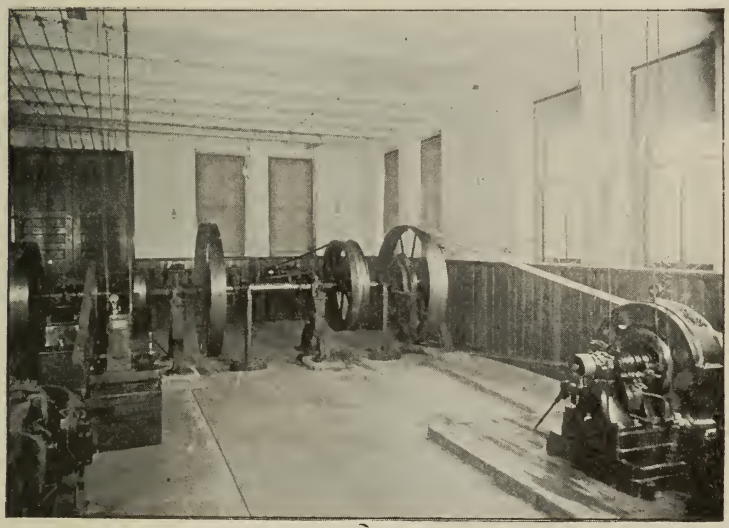
The object of the laboratory course is not original research, but the acquirement of a certain familiarity with the subjects which this work alone can give. During the first part of the course the student acquires facility in the use of instruments, and accuracy in measurement. The experiments are quantitative, and are selected with the view of illustrating the fundamental principles of the subject, rather than of devoting the student's whole time to the elaborate determination of a few constants.

The equipment is fairly complete. A fine Troemner and an excellent Sartorius balance belong to the laboratory, while a number of balances from the chemical department are available during a part of the time. Forty micrometers and vernier callipers are provided, as well as spherometers, protractors, etc. Jolly balances, hydrometers of various kinds, thermometers, a fine Kater's pendulum, lenses, mirrors, galvanometers, resistance boxes, Wheatstone bridges, apparatus for the determination of the law of the pendulum and for the determination of Young's modulus, form part of the equipment, which has received material additions during the school year just past.

ELECTRICAL ENGINEERING.

PROF. HILL. MR. HAZARD.

The course in Electrical Engineering is intended to cover both the theoretical and practical parts of the subject. It is adapted to the needs of the State by the devotion of much time to the application of electricity to mining and metallurgy.



DYNAMO ROOM.

In the third and fourth years, work in Mechanical Engineering forms a considerable part of the course. Tests of steam engines, boilers and water wheels are made from time to time. The engine is fitted up for testing, as is the eighty horse-power boiler furnishing steam to Engineering Hall. The course in Electrical Units and Measurements

consists of lectures on the theory and value of the units of the science and the modern methods of measurement. Four hours per week are devoted to work in the laboratory.

The course in the Distribution of Electricity embraces distribution for lighting and the various systems for the transmission of power.

Lectures on the theory and design of Dynamo-Electric Machinery occupy the student five times a week, during the fourth year. Two full afternoons per week, in addition, are devoted to work in the laboratory and in the designing room. Alternate currents and alternate current transformers occupy a large portion of the time during this year.

The laboratory work of the fourth year consists of insulation and capacity tests, measurement and location of faults, determination of magnetization curves of iron and steel, determination of characteristic curves of various machines, and of tests of dynamos and motors, as well as standardizing and calibrating various instruments.

Besides the space occupied by the general lecture room and the Physical Laboratory, a large room is fitted up on the second floor for work in Photometry. In addition to the Bunsen photometer, a complete "Reichsanstalt" standard photometer, with all accessories, has recently been added to the equipment of this room. The various experimental machines are belted to pulleys on a jack shaft, driven by the engine in the dynamo room. The instruments for use in testing are in a smaller room adjoining, where the marble switch board and the large resistance coils are also placed. Separate wires run to each room from both the alternate and continuous current circuits and also from the sixty-cell accumulator purchased from the Electric Storage Battery Company. The rooms on the north side of the building devoted to electrical measurements, have little iron used in their construction, while the room designed for magnetic measurements has none. These rooms are equipped with piers, non-inductive resistances, gas, water and direct connections to all circuits, besides the ordinary galvanometers, resistance boxes, balances and other instruments.

The department, in addition to these appliances, is well equipped with high grade galvanometers and the ordinary apparatus for electrical measurements. Dynamometers, of various types, and wattmeters enable efficiency tests to be conveniently made. Kelvin balances, electrostatic voltmeters, ammeters, and voltmeters of various makes, form part of the equipment.

Through the kindness of Gen. Irving Hale, the department has been presented with a twenty-five horse-power motor.

To Mr. Paul Webster, a former student of the institution, the department is indebted for a small steam engine.

Mr. John Pipe has recently presented the department with a dynamo of considerable historical interest.

PRIME MOVERS AND POWER TRANSMISSION.

PROF. HILL.

The course of Hydraulics, given during the first term of the Senior year, embraces the study of the laws governing the flow of water in pipes, conduits and open channels, as well as the measurement of water by weirs and orifices. The class room work is supplemented by practical experiments in the laboratory and in the field. The latter part of this term is devoted to the study of pumping machinery, special attention being given to mine pumps. This department has been presented with a good collection of pumps of various makes, which will be tested by the class.

During the second term five lectures per week are given on Power Transmission and the Steam Engine. Teledynamic Transmission receives some attention, although electric and compressed air methods of transmitting power occupy most of the time.

MECHANICS.

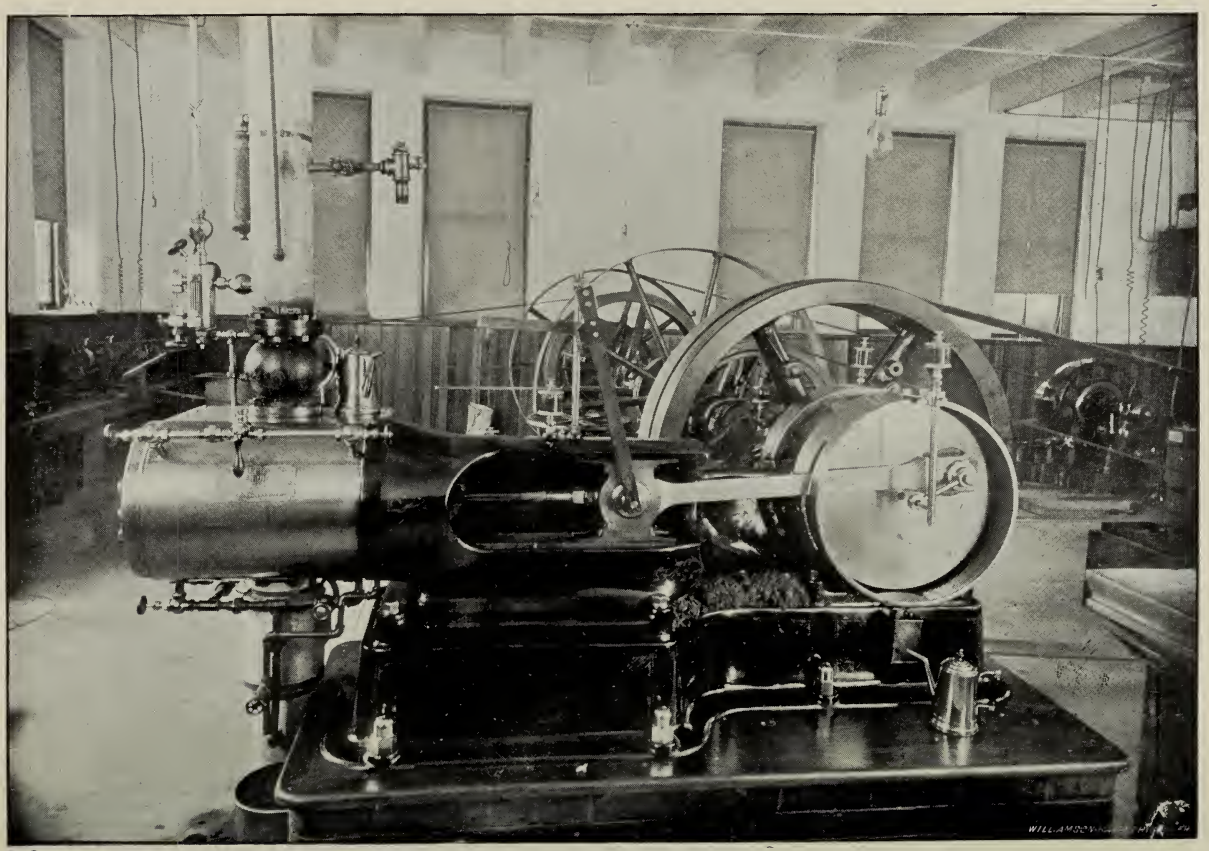
PROF. COMSTOCK.

This course occupies three hours per week during the entire Junior year. It includes Kinematics, Statics and Kinetics. In the development of formulae and methods free use is made of mathematical ideas and symbols. A knowledge of the Differential and Integral Calculus is a necessary preliminary to the study of this subject as here pursued. The practical applications are, however, kept constantly in view and approximate methods are introduced whenever they can be shown to be sufficiently exact and to materially simplify the results. The students are encouraged in every way to rely upon their own reasoning powers, and to guard against a mere copying of book or class-room processes. They are taught to reason from fundamental principles in all cases, and to avoid "rule of thumb" work.

Great importance is attached to the study of this subject and a corresponding thoroughnesss on the part of the student is required. Mechanics is the basis of all successful work in the design of structures or machines, and without it the designer works in the dark. The profitable operation of many mining and metallurgical enterprises is dependent entirely upon the perfection of the mechanical appliances in use. The greatest difficulties which the engineer has to combat when he undertakes to carry on mining operations at the extreme depths now reached in many parts of the world are of a mechanical nature. Many of the reductions in the cost of ore treatment which have rendered profitable the extraction of very low grade materials, have been due entirely to the substitution of mechanical methods for manual labor.

On account of the important part which this subject plays in the professional studies of the latter part of the course, no student markedly deficient in it is considered competent to undertake the work of the Senior year.

The text-book used in this course is Liwet's "Theoretical Mechanics."



ENGINE IN BASEMENT OF ENGINEERING HALL.

GRAPHICAL STATICS.

PROF. COMSTOCK.

Two hours per week of lecture and text-book work, and one afternoon per week of drafting are given to this subject during the second term of the Junior year. The properties of reciprocal figures, the equilibrium polygon and the frame pencil are developed and illustrated in the class-room and applied to numerous problems by the student in the drafting room. Each student determines the stresses in a number of framed structures under the various loading to which they are subject. Roof trusses, iron building frames, gallows frames, bridge trusses, trestle bents and cranes are among the structures assigned to members of the class of analysis.

Although great importance is attached to the graphical method, the analytical determination of stresses is not neglected and at least one frame is treated by both methods and the results compared.

The effect of the rigidity of certain classes of frames upon the stresses in their members is studied, and several methods for the calculation of deflections and the stresses in redundant members are developed.

The graphical determination of bending moments in pins and shafts subject to non-coplanar forces is taken up both in the lecture and drafting rooms.

It is intended that this course shall cover the ground preparatory to actual structural design, which is taken up in the Senior year.

The text-book used during the first half of the course is Greene's "Graphical Analysis of Roof Trusses."

THEORY OF CONSTRUCTION.

PROF. COMSTOCK.

In this course the principles and methods developed in the study of Mechanics and of Graphical Statics are applied to the design of various structures. The first lectures take up the Mechanics of Materials including the design of beams and columns. This work is followed by a study of more complicated structures such as wooden and steel roofs and buildings, gallows frames, trestles, flumes, masonry arches, dams, retaining walls, chimneys and foundations. Standard specifications are discussed with great care. Theories which are incomplete are supplemented by accounts of methods adopted in existing structures. Records of failures are studied, and the causes pointed out whenever they can be ascertained. The limitations put upon theoretical results by labor conditions, and the means available for executing the work, are considered. Economic considerations are kept in view, and students are taught that *least cost* is the first essential. Nor is it forgotten that first cost is not the only cost, the question of durability being carefully studied.

Each student makes several designs of structures, both framed and masonry, and executes complete working drawings, bills of material and detailed estimates of cost.

Two lectures each week of the first Senior term are given to this subject. Baker's "Masonry Construction" is used as a text during a portion of the term. During its remainder, no text is specified, but Johnson's "Engineering Contracts and Specifications," and "Modern Framed Structures," are used as supplements to the lecture work.

In the laboratory each student makes a prescribed series of tests on wrought iron, steel, cast iron, wood, building stone and brick. The tests on wood are conducted by the methods developed in the work of the United States Bureau of Forestry, and tests on all other materials by the most approved methods now in use. For this work the laboratory is supplied with a Riehle testing machine of one hundred thousand pounds capacity, fitted for work in tension, compression and transverse testing.

The Carnegie Steel Company, Limited, has presented to the Engineering Department a complete series of sections of structural steel.

MINING AND METALLURGICAL DESIGN.

PROF. COMSTOCK. PROF. CLERC.

Two afternoons each week during the Senior year are given to the design of a plant for the operation of a mine or for the treatment of ores. The student's preference is regarded to some extent as to the character of the plant. These designs are very complete, and involve careful study of structural, mechanical and metallurgical features. The buildings are designed in accordance with standard specifications, and rigid adherence to the best mechanical and metallurgical practice is required. A site is assigned for each plant, the student surveys it and does his work in all respects as though the structure were to be built. The problems are all different, and though the requirements correspond to existing conditions in some American mining region, they are so arranged that mere copying of a plant already built, is impossible. All work is based on careful computations, and a good reason for everything is insisted upon. Each student hands in a complete set of *working* drawing of his buildings, furnaces, etc.; detailed specifications for their construction; a bill of material for the entire plant, and an estimate of the total cost.

Among the problems recently assigned are a plant for handling fifteen hundred tons daily from a depth of three thousand feet; a lead smelting plant of one thousand tons daily capacity; a three hundred ton cyanide mill; a plant for working one of the largest mines in Cripple Creek; a five hundred ton chlorination mill and several concentrating mills for treating assigned ores.

SURVEYING.

PROF. STOCKTON. MR. WEISS.

The instruction in this course covers both the theoretical and practical part of surveying, the aim being to convey to the student a broad understanding of the subject and its special application in the professional work of the Mining Engineer.

The institution is well supplied with the necessary instruments for practical work in the field. Among these may be mentioned: Five light mountain transits each provided with some standard form of solar attachment; two of these transits are provided with auxiliary telescopes, for taking highly inclined sights in underground work. Also, one mining transit with side telescope, one heavy triangulation transit, one ordinary heavy engineer's transit with Saegmuller attachment, five wye levels and one needle compass, together with all the necessary accompanying apparatus, such as tapes, level rods, stadia boards, etc.

The class instruction begins with adjustment and use of the transit, and the principles of Land Surveying, the field work consisting of traverses, and various problems designed to familiarize the student with the actual handling of the transit and tapes, and to illustrate the care necessary to secure good results. The problems are all plotted and handed in, accuracy being insisted upon.

The use and adjustments of the level are treated in the

same order as with the transit. After adjusting, the students are given simple exercises in differential leveling until they have become familiar with the instruments. Then some problem involving profile leveling is undertaken, such as the determination of street grades or sewer lines from the profiles. The further use of the level is left until the subject of Railroad Surveying is reached.

In Topographical Surveying, each class makes a survey of some favorable place by the transit and stadia method. From the notes taken a contour map is drawn with a view to locating the best position for a dam or reservoir site, or with a view to city improvements.

In City Surveying, classes are instructed in regard to the methods of laying out cities and towns, resurveys to locate lots described in deeds or on plats, surveys for street improvements, giving of grades, etc.

The determination of the true meridian by means of the various Solar Attachments is made clear by the discussion of the astronomical principles involved, and the adjustment and use of these attachments in the field. In this connection the method of direct solar observation for meridian is given. During the course each student is required to determine the true meridian by making an observation on the pole star; he is also required to find the latitude by an observation of the sun, using transit, solar attachment or sextant.

Mining Surveying includes the methods used in locating and patenting mining claims, and in underground surveying. Each party undertakes the complete survey of a mining claim for patent, going through all the work a U. S. Deputy Mineral Surveyor would have to do, field work, calculations and the preparation of the preliminary plat and field notes according to the requirements of the Surveyor General's office. The lectures given on this subject enter into the detail in which it is involved and touch upon the mining law relating to surveyors and the patenting of mining property.

The theory and practice of underground surveying is

fully discussed, especial attention being paid to the instrumental difficulties and unique problems encountered. The field work includes the survey of some mine in the vicinity, and the making of the accompanying computation and maps.

In Geodetic Surveying, classes are instructed in the outlines of that subject, including the different kinds of triangulation, a description of the United States Coast Survey base apparatus and the establishment of stations and signals. A base line is measured with a three-hundred-foot steel tape and all corrections made so as to eliminate errors of sag, pull, temperature and grade. On this rests a system of triangulation of the neighboring peaks, all angles being measured and adjusted, and distances computed.

In Railroad Surveying, students are instructed in the theory of Railroad Curves, running of levels and the measurement of earthwork. The time in the field is devoted to a projected line with preliminary and location surveys, topography, cross-sectioning and preliminary and final estimates of earth work.

The liberal time scheduled, coupled with the fact that our winters are usually mild and open, allows very thorough instruction in the field and admits class instruction and the field work devoted to the same subject, to occur practically at the same time.

In field practice the class is divided into groups, so as to allow the maximum amount of practice to each individual. The members of the groups alternate as to duties, so that each one in turn has ample opportunity for mastering every detail.

The instruments above noted are of the best makes. Among them may be mentioned, Buff & Berger, Heller & Brightley, W. & L. E. Gurley, Keufel & Esser and Young & Son.

Additions are constantly being made, keeping pace with the growth of the school.

Many students, in the vacation between their Junior and Senior years, have secured employment at underground or surface surveying in various mining "camps."

DRAUGHTING.

PROF. CURTIS. MR. HAZARD. MR. HALDANE.

It is the object of this department to first give a thorough grounding in all the more elementary parts of Mechanical Drawing, and to follow this with their application in the most practical way possible in a technical school.

SOPHOMORE DRAFTING ROOM.

The student is first taught the proper way of using his instruments, preparing his sheets, etc., and then given the simplest of geometrical figures, to cultivate some skill in their use. At this time individual instruction is given each student.

The work then leads into the more difficult elements of drawing, including line shading and tinting, together with lettering, and no student is allowed to proceed who can not neatly execute at least two alphabets in free-hand.

Then follows the more difficult work in connection with the subject of Descriptive Geometry, including a large number of elementary problems, leading gradually into the advanced work of that subject, and ending with problems in shades and shadows and isometric projections. This completes the purely elementary work.

In this work, as in the more advanced, no grades are given. Each drawing must reach a certain standard, such as would hold in any well regulated drawing office, before being accepted, and under these conditions all drawings are of the same rank, except as to artistic effect, which is not a requisite of pure Mechanical Drawing.

The advanced drawing is all of practical nature. The elements which have been mastered in the previous years are here combined, and only the methods used in the best American drawing offices are followed.

To this end, the drawing rooms have been equipped with the most efficient appliances. The Freshmen have large, rigid drawing tables, with ample room for each individual, and the advanced classes have improved individual tables, adjustable in every way, the light being reflected from the perfectly white walls, giving a mild diffused light, much preferred to strong direct light.

The blue-print room is complete in every way, and students are taught to make prints either from tracings, or direct from the bond papers now so much used.

Applicants for advanced standing must bring with them the work they have executed in Mechanical Drawing, or in Descriptive Geometry

The work by years is as follows:

FRESHMAN YEAR.

The work of the first term includes the use of drawing instruments, mounting sheets, etc. The proper selection of instruments, testing and care of pen points, and like details, all of great importance to the beginner. Plain geometrical problems, simple projections and intersections; plans, eleva-

tions and sections, exercises in lettering, both free-hand and with the instruments; line shading, tinting and shading with tints; with applications of each as in working drawings. The working of problems, as given in Church's Descriptive Geometry, including a large number of exercises relating to the first seventeen problems as there given. In the second term problems in intersections, including the intersections of planes with cylinders, planes and cones, planes and surfaces of revolution, surfaces of revolution with surfaces of revolution, etc.; exercises in shades and shadows, and isometric projections, occupy the whole time.

SOPHOMORE YEAR.

At the beginning of this year the study of Elementary Mechanism is taken up in the class-room and continues throughout the year.

The whole of the first term is occupied with problems involving the continual use of the principles of Descriptive Geometry in the representation of actual machine parts.

The rest of the year is given over to problems in Mechanism. This includes the laying out of lobed wheels, spur wheels, beveled wheels, sprocket wheels, cams, special motions with link work, etc.

Blue printing is explained at the beginning of the year, and the student becomes practiced in the process by making prints of his own work from time to time.

Special pains are taken all through this year to get the student in the way of making good working drawings according to the best American practices.

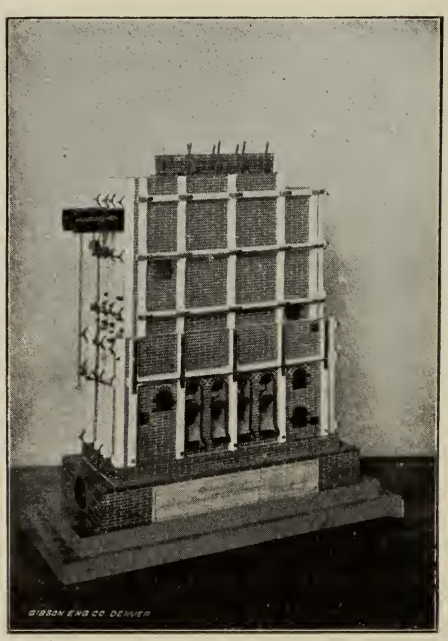
JUNIOR YEAR.

The study of Machine Design is taken up in the class-room at the beginning of this year and continues through the year. The drawing is all in conection with this study, and includes the designing of such parts of machines as follows: bolts and nuts; keys and cotters; pipes and pipe joints; shafting and shaft couplings; journals and journal bearings;

arms, hubs and rims of gear wheels, belt wheels, sheave wheels, etc. Rivets and riveted joints; belts and gearing, brackets and pillow blocks, with other devices, are all explained and drawn.

SENIOR YEAR.

The Draughting of this year is distributed among the several departments of Metallurgy, Engineering and Electrics. Designs assigned according to the special work of the student, are executed of metallurgical plants, masonry work and bridges, and of electrical machinery. The draughting of this year, in short, is not intended as instruction in draughting, but as applied work.



LIBRARY.

The Library contains nearly five thousand volumes, (exclusive of pamphlets,) mostly standard scientific and technical works, though history and travels are not neglected. Its cost per volume, as must be the case with scientific works, has been large.

Complete sets of the transactions of the institute of mining engineers, civil engineers, association of engineering societies, journals of chemistry, electricity and metallurgy, and technical cyclopedias in various lines, are among the recent additions.

The shelf and catalogue arrangements are upon the Dewey decimal system. Pamphlets are separately placed in special drawers, also under classification.

The authorities of the institution desire to acknowledge the generosity of Capt. Edw. L. Berthoud, a trustee of the school, and of Mr. Edw. G. Stoiber, of Silverton, Colorado, in presenting a number of valuable works.

APPARATUS AND MACHINERY.

The scientific apparatus in the various departments can hardly be named in detail in the catalogue. Reference should be made to the headings "Departments of Instruction," under which some description will be found.

The estimate for the year 1900 on the value of apparatus and machinery is $55,000, which figure is *exclusive* of all furniture, fittings, desks, cases or ordinary school appliances.

BUILDINGS AND GROUNDS.

(1). BUILDING OF 1880-'82.

The combined building of 1880-'82, has the main dimensions of 100x70 feet, two stories, and basement extending under most of the space.

The Riehle testing machine (see "Mechanics"), stands in the south basement, which contains besides, rooms for testing of material and for the storage of laboratory supplies.

The main floor is wholly occupied by chemical laboratories, balance rooms, and rooms for the storage and issue of apparatus. (See "Chemistry.")

The second floor contains the main lecture room for mathematics. The lecture room for general chemistry is next in order, with annex room for apparatus.

Special laboratories (50x25) are also upon this floor, the remainder of whose space is occupied by several small rooms for balances and apparatus of various kinds.

(2). BUILDING OF 1890.

The length of this building is one hundred feet; its width from fifty-seven to sixty-eight feet. Its basement contains the gymnasium (q. v.) lavatories, shower bath, work-shop, steam-heating, boiler and gas apparatus.

The first floor contains the offices of the Registrar, library and reading room, and the department of geology and mineralogy. The latter is divided into three rooms, one for the museum, two for working departments and lecture room.

The second floor is divided into: (1.) Lecture room for metallurgy, containing also the collections and models for this department. (2.) Lecture room for mathematics, chiefly devoted to Freshman work. (3.) Lecture room for engineering classes. (4.) Lecture room, used by various classes. (5.) Office rooms for Professors.

The fourth floor is occupied by the Freshman Draughting room. The space is four thousand square feet. This fine room is lighted partly by windows, but largely by skylights, and is fitted up with conveniences for stretching and washing drawings, and other appliances. It will accommodate over one hundred and twenty students.

This building stands upon ground overlooking the town, and presents a handsome appearance. It was first occupied at the opening of the fall term of 1890.

(3). BUILDING OF 1894 (HALL OF ENGINEERING).

Engineering Hall is a three-story brick and stone structure, fifty by seventy-five feet. The lower floors are devoted to Physics and Electricity, the upper floor contains two large draughting rooms, a blue-print room, and Professor's office.

The second floor is devoted to Physics and to elementary work in Electricity and Magnetism. The lecture room, furnished with raised seats, will accommodate seventy students. For experiments in light, the room can be quickly darkened. The photometer room is fitted for experiments in light and the measurement of arc and incandescent lamps. The room devoted to laboratory work in Physics and Elementary Electrical Measurements, is well lighted and fitted with slate shelves and heavy tables. Gas, air, water and electricity are supplied at various points in the laboratory.

The south half of the lower floor is divided into two rooms, the larger containing the fifty horse-power, high-speed engine, the dynamos and motors for testing purposes. All wires run from this room to the smaller, which contains

the slate switch board, the measuring instruments for testing work, and the large resistance coil. A small workshop connects with the dynamo room. The battery room, floored with tiles, contains the sixty-cell accumulator and various primary batteries. Three light rooms furnished with piers, on the north side of the building, are devoted to advanced work in Electrical Measurements. Very little iron is used in the construction of the lower portion of the building, so that all the rooms are well adapted for electrical measurements.

The boiler house contains the Sturtevant engine and fan, eighty horse-power boiler, feed pumps, heater, etc.

R. S. Roeschlaub, of Denver, was the architect of the buildings of 1890 and of 1894.

The total floor space in the three buildings is over forty-five thousand square feet.

(4). BUILDING FOR FIRE ASSAYING.

This building is described under its proper heading, page 40.

(5). GROUNDS.

The tenth General Assembly gave $5,000 for improvement of the grounds, the City of Golden permitting the absorption of the street formerly dividing Engineering Hall from the other buildings. Stone walks, terraces and grass plats now give to the entire premises a finish long lacking.

A final readjustment of the space in the buildings of 1880, 1882, and 1890, effected in the fall of 1900, allows the utilization of all the space hitherto unavailable.

The site, well above the main part of the town, is admirable both for scenic and sanitary environment.

A recent purchase of land in the immediate vicinity of the present grounds affords space for future expansion, a necessity already indicated by the rapid rise in numbers.

ASSAY LABORATORY. 1900.

THE SCIENTIFIC SOCIETY.

In conection with the school is the organization known as the "Technical and Scientific Society of the Colorado School of Mines," composed of active members from the Senior and Junior classes, the Faculty and the Alumni of the School. Sophomores and Freshmen are associate members.

The object of the society is the presentation and discussion of papers on technical and engineering subjects, so that the special knowledge of one member may be shared by all. A secondary object is the benefit to be derived from addressing a public assembly, giving the members a confidence in themselves which may be of value to them in their careers.

A salient feature of the society is the delivery of lectures, from time to time, by professional men and members of the Alumni, who have had practical experience in their several branches of engineering.

Officers are elected each year from the Senior class.

The programmes are prepared by an appointed committee selected from the Senior and Junior classes. The meetings are held monthly in the school building.

Officers for the year 1900-1901 are as follows:

President.....Arthur C. Brinker (1901).
Vice President.....Ralph De Cou (1901).
Secretary.....Edward S. Bumsted (1901).
Treasurer.....Jos. M. Bradley (1901).

ALUMNI ASSOCIATION.

The Association of the Alumni of the Colorado School of Mines holds its annual meeting and banquet on the day following the commencement exercises, unless otherwise provided by the executive committee.

All graduates holding degrees are eligible to membership, and are invited to the annual meeting and banquet.

The aim of the Association is to promote acquaintance and friendship among the graduates, to encourage them to aid each other, and to make an organized effort to elevate and uphold the reputation and standard of the Alma Mater.

All graduates are earnestly requested to join the organized body, and to keep the Secretary advised as to their addresses.

The officers of the Association for the year ending June 15th, 1901, are as follows:

President	Edward P. Arthur, Jr., (1895).
1st Vice President	Jesse E. Dwelle (1896).
2nd Vice President	Thos. G. Smith (1899).
Secretary and Treasurer	Robert S. Stockton (1895).
Executive Committee	O. B. Suhr (1895).
	Chas. T. Durell (1895).
	Robert Nye (1897).

DIRECTORY OF GRADUATES.

NAME AND ADDRESS.		OCCUPATION.
	1883.	
Middleton, Wm. B. Denver, Colorado.		Mining Engineer.
Wiley, Walter H. Denver, Colorado.		Mining Engineer.
	1886.	
van Diest, Edmund C. San Luis, Costilla County, Colorado.		Superintendent, Maxwell Land Grant.
Gehrmann, Charles A. Idaho Springs, Colorado.		Superintendent, Consolidated Stanley Mining Company.
	1888.	
Ambrosius, Carl E. Guanacevi, Durango, Mexico.		Mining Engineer.
*Floyd, John A.		
Kingman, Jerry Los Angeles, California.		Chemist.
*Lorah, Bela I.		
	1889.	
Bellam, Henry L. Anaconda, Montana.		Chemist, Anaconda Mining Company.
Craigue, Wm. H. Colorado Springs, Colorado.		Mining Engineer.
*Wertheim-Salomonson, F. M. G. A.		
	1890.	
Comstock, Chas. W. Denver, Colorado.		Professor of Mining Engineering, Colorado School of Mines.

*Deceased.

NAME AND ADDRESS.	1891.	OCCUPATION.
Johnson, Edward W. Leadville, Colorado.		Assistant Supt. Arkansas Valley Smelter.
Smith, Charles D. Atacama, Peru, S. A.		Metallurgist.
	1892.	
Aller, Frank B. Peru, S. A.		Metallurgist, with M. Guggenheim.
Brown, Norton H. Denver, Colorado.		Surveyor General's office.
Budrow, Wm. B. Aguas Calientes, Mexico.		Chemist, La Gran Fundicion.
Cole, Burt Los Angeles, California.		Engineer.
Hindry, Willis E. El Oro, Mexico.		Superintendent, Esperanza Mine.
Kimball, George K., Jr. Idaho Springs, Colorado.		Chemist, Kilton Ore Purchasing Company.
Kimball, Jos. S. Denver, Colorado.		Surveyor General's Office
Lewis, Wm. B. Denver, Colorado.		Manager, Denver Sulphite Fibre Co.
McMahon, Charles H. Sombrerette, Zacatecas, Mexico.		General Superintendent, Sombrerette Mining Company.
	1893.	
Collins, Philip M. Georgetown, Colorado.		Assayer.
Hawley, R. Howard Monterey, Mexico.		Chemist, National Mex. Smelting Co.
Jewell, Gilbert E. Chartres Towers, Queensland, Australia.		Metallurgist.
Milliken, Wm. B. Florence, Colorado.		Vice Pres. & Gen. Man. Union Gold Ext. Co.

NAME AND ADDRESS.	1893.	OCCUPATION.
Osborne, Arthur H. Victor, Colorado.		Surveyor.
Stephens, Wallace A. Denver, Colorado.		Metallurgist.
	1894.	
Atkins, Horace H. Denver, Colorado.		Omaha and Grant Smelting Co.
Bowie, James W. Gallup, New Mexico.		Mine Superintendent, Caledonia Coal Co.
Post, George M. Denver, Colorado.		Lawyer.
Saint Dizier, Julius L. San Luis Potosi, Mexico.		Engineer, Compania Metalurgica Mexicana.
Schneider, George W. Central City, Colorado.		Asst. Man. Kansas, Burroughs Mine.
Wheeler, Charles E. Victor, Colorado.		
	1895.	
Arthur, Edward P. Cripple Creek, Colorado.		Surveyor, U. S. Dep.
Davis, Carl R. Rossland, B. C.		Supt. War Eagle and Center Star M. Co.
Dockery, Love Atkins Mapimi, Durango, Mexico.		Mine Superintendent, Cia. Minera de Penoles.
Durell, Charles T. Randsburg, California.		Mine Surveyor, Yellow Aster M. & M. Co.
Eaton, Albert L. Leadville, Colorado.		Assayer, Penn M. & L. Company.
Eye, Clyde M. Florence, Colorado.		Chemist, Rocky Mt. Smelter.
Field, Fred M. Pony, Montana.		Metallurgist, (Cyanide).
Gray, Latimer D. Rock Springs, Wyoming.		Manager, Electric Dept. U. P. Coal Co.

NAME AND ADDRESS.	1895.	OCCUPATION.
Hartzell, Lester J. Phillipsburg, Montana.		Chemist, Granite and Bimetallic Min. Cos.
Kennedy, George A. Silverton, Colorado.		Asst. Gen. Man. Iowa G. M. & M. Co.
Limbach, Edmund C. Victor, Colorado.		Surveyor.
Maxwell, Fred. A. G. Randfontein, S. A. R., Africa.		Metallurgist, Porges Randfontein Mining & Milling Co.
Merryman, Herbert E. Cripple Creek, Colorado.		Surveyor.
Parker, James H. New York, N. Y.		Student, Columbia University.
Rowe, Edward E. Denver, Coiorado.		Manufacturer.
Shetler, Waverly Montanas, Estacion Alamo, N. Leon, Mex.		Supt. of Montanas Mines of La Gran Fundicion.
Skinner, Lewis B. Colorado City, Colorado.		Chemist, Colo.-Phila. Reduction Company.
Stannard, Burt C. Everett, Washington.		Chemist, Puget Sound Reduction Company.
Stockton, Robert S. Golden, Colorado.		Professor of Mathematics and Surveying Colo. School of Mines.
Suhr, Otto B. Norris, Montana.		Engineer, Telluride Power Trans. Co.
Titsworth, Frederick S. Denver, Colorado.		Engineer, 207 Boston Building.
Wallace, Lewis R. Morenci, Arizona.		Detroit Copper Company
Young, Frank B. Denver, Colorado.		

NAME AND ADDRESS.	1896.	OCCUPATION.
Atkinson, Walter J. Chicago, Illinois.		Civil Engineer.
Barensheer, Wm. J. Argentine, Kansas.		Assayer, Consolidated K. C. S. & R. Co.
Barnes, Corrin Cripple Creek, Colorado.		Assayer and Surveyor, Benjamin & Barnes.
Beeler, Henry C. Cambria, Wyoming.		Cambria Mining Company.
Dwelle, Jesse E. Ameca, Jalisco, Mexico.		Chemist.
Griswold, George G. Denver, Colorado.		Chemist, Globe Smelter.
Hoyt, George F. Oakdale, Fulton County, Georgia.		Metallurgist.
Maynard, Rea E. Honolulu, Hawaiian Islands.		
Mitchell, George B. Washington, D. C.		Surveyor, Isthmian Canal Commission.
Milliken, John T. Elkton, Colorado.		Manager, Arequa Mill Colo. Ore Reduction Co.
Nance, Wm. H. St. Louis, Missouri.		St. Louis Smelting & Refining Company.
Newman, Wm. E. Omaha, Nebraska.		Chemist, Omaha & Grant Works.
Paul, Wm. H. Central City, Colorado.		Assayer, Standard Assay Office.
Strout, Fred McL. Telluride, Colorado.		Assayer and Chemist, Cimarron Mine.
	1897.	
Buck, Arthur H. Mapimi, Durango, Mexico.		Mine Surveyor, Cia. Minera de Penoles.
Bussey, Edwin E. Denver, Colorado.		Assayer.

NAME AND ADDRESS.	1897.	OCCUPATION.
Canning, Herbert A. Victor, Colorado.		Superintendent, Granite Mine.
Cohen, Louis Black Hawk, Colorado.		Assayer, State Ore Sampling Works.
Draper, Marshall D. Central City, Colorado.		Superintendent Notaway Mine.
Febles, John C. Pueblo, Colorado.		Chemist, Colorado Smelter.
Gross, John Sombrerette, Zacatecas, Mexico.		Superintendent, Mills of Sombrerette M. Co.
Hazard, W. J. Golden, Colorado.		Instructor, Colorado School of Mines.
Jarvis, R. P. New York, N. Y.		Student Columbia University.
Kelley, W. A. Denver, Colorado.		Chemist, McArthur-Forest Company.
Lerchen, F. H. Scranton, Pennsylvania.		Chemist, Colliery Eng. Company.
Logue, N. W. Leadville, Colorado.		Assayer, Ibex Mining Company.
McLeod, J. Norman Central City, Colorado.		
MacGregor, George H. Estes Park, Colorado.		
Nelson, H. E.		Draughtsman.
Nye, Robert Denver, Colorado.		Chemist, The G. & S. Extraction Co. of America, Ltd.
Powell, Geo. F. New Prospect, Tennessee.		Chemist.
Roller, Arthur H. Idaho Springs, Colorado.		Assayer State Ore Sampling Works.
Schumann, Enrique A. New York, N. Y.		
Starbird, H. B. Victor, California.		Superintendent Rose M. & M. Co.

NAME AND ADDRESS.	1897.	OCCUPATION.
Warnecke, Carl M. Sherman, California.		Electrician, Los Angeles & Pacific Ry. Co.
Weed, Floyd Denver, Colorado.		Chemist, The G. & S. Extraction Co. of Amerca, Ltd.
Woods, Thomas H. Ouray, Colorado.		Camp Bird Mine.
	1898.	
Barbour, Percy P. Francis, Boulder County, Colorado.		Assayer, Big Five Mining Co.
Bertschy, Perry H. Elkton, Colorado.		Assayer, Arequa Mill.
Blumenthal, Emil E. Phillipsburg, Montana.		Chemist, Granite & Bimetallic Mining Co.
Caldwell, Florence H. Cleveland, Ohio.		
Church, Myron J. Ahuacatlan, Tepic, Mexico.		Manager, Two Republics Gold Mining Co.
Clark, Winfred N. Victor, Colorado.		Electrician, Portland G. M. Co.
Corry, Arthur V. Kingman, Arizona.		Manager, New England & Arizona Mining Co.
Davey, Wm. R. Lake City, Colorado.		Assayer.
Dollison, James E. Alma, Colorado.		Assayer.
Hamilton, Frank R. Ouray, Colorado.		Assayer, Camp Bird Mine
Harrington, Orville Denver, Colorado.		
Ingols, J. August Cripple Creek, Colorado.		
Johnston, Fred Leadville, Colorado.		Chemist, Weldon M. Co.
Jones, Frank H. Leadville, Colorado.		Assayer and Surveyor.
Kræmer, Edw. L. Phillipsburg, Montana.		Assayer, Granite Bimetallic M. Co.

NAME AND ADDRESS.	1898.	OCCUPATION.
Lampe, Oscar A.	Parral. Mexico.	Assayer.
Lucy, Richard W.	Denver, Colorado.	Surveyor, Colorado & Southern Ry.
Magenau, William	Mapimi, Durango, Mexico.	Assayer, Cia. Minera de Penoles.
Norman, John Edw.	San Luis Potosi, Mexico.	Chemist.
Rodriguez, J. Crisostomo	Saltillo, Mexico.	Mine Superintendent.
Smith, Harry C.	Victor, Colorado.	Surveyor, Woods Invest' ment Co.
Stephens, Charles N.	Denver, Colorado.	Surveyor General's Office.
Valentine, Malvern R.	Victor, Colorado.	Assayer, Taylor & Brunton Sampler.
Whitaker, Orvil R.	Silverton, Colorado.	Silver Lake Mine.

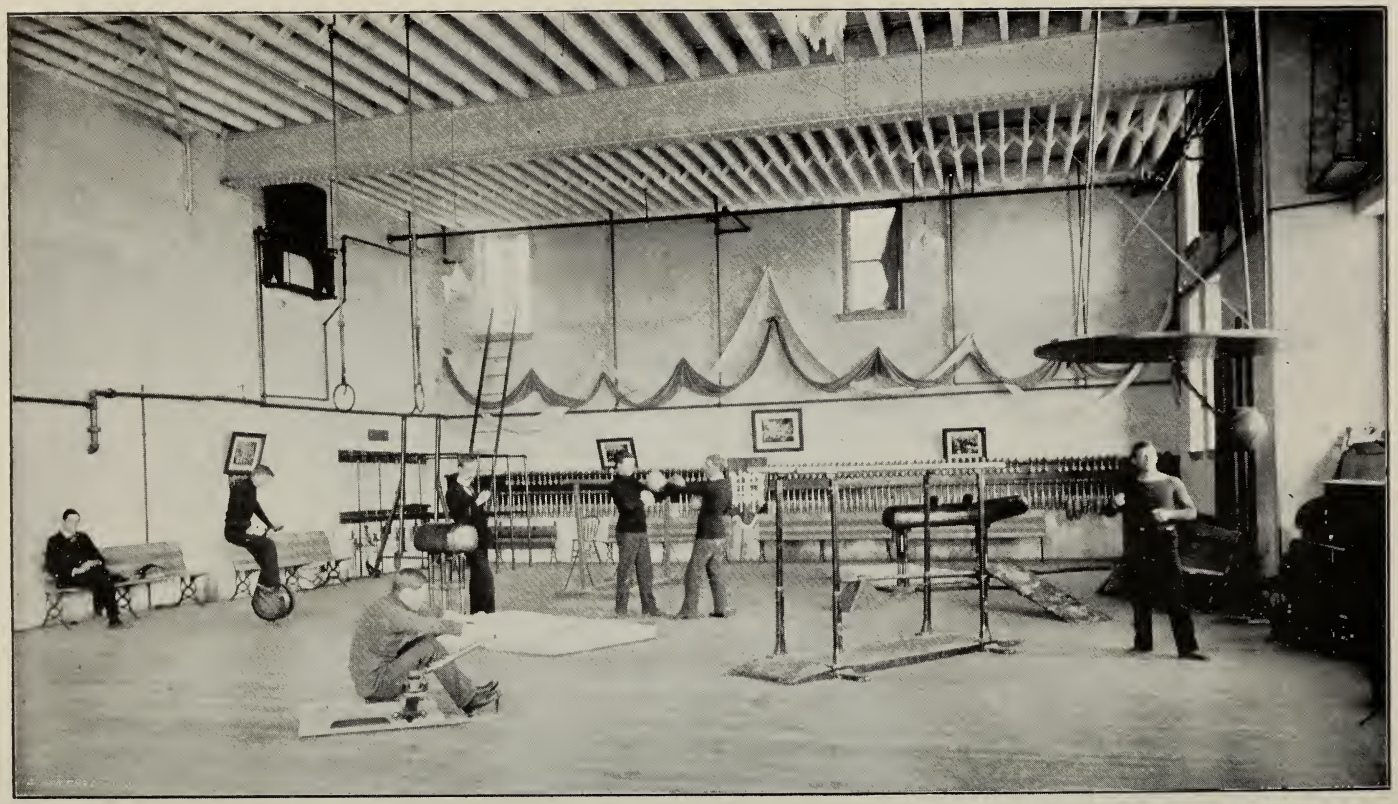
1899.

Adami, Charles J	Butte, Montana.	Asst. Engineer, Boston & Montana Con. G. & S. M. Co.
Bruce, Stuart S.	Leadville, Colorado.	Eng., Const. Dept. Arkansas Valley Smelter.
Cramer, Curtis P.	Fierro, New Mexico.	Gilchrist & Dawson Co.
Davis, Gilbert L.	Leadville, Colorado.	Surveyor and Assayer Iron-Silver Co.
Grant, Lester S.	Cripple Creek, Colorado.	Surveyor, Isabella Gold M. Co.
Hodgson, Arthur	Denver, Colorado.	Assayer, Denver Mint.
Johnson, Gilbert J.	Ouray, Colorado.	Assayer and Surveyor, American Nettie Mine.
Kelley, Fred G.	Black Hawk, Colorado.	Surveyor, Boston & Denver Cons. M. & M. Co.

NAME AND ADDRESS.	1899.	OCCUPATION.
Muir, David. Ydalpom, Shasta County, California.		Assayer, Bully Hill Mine.
Rising, Arthur F. Perth Amboy, New Jersey.		Ass't Chemist, Raritan Refining Co.
Royer, Frank W. Arastra, Colorado.		Assayer, Silver Lake Mine.
Smith, Thos. G. Denver, Colorado.		Chemist, Omaha & Grant Smelter.
Steinhauer, Frederick C. Denver, Colorado.		Asst. Engineer, Eastern Division C. F. & I. Co.
Thompson, James S. Denver, Colorado.		Asst. Engineer, Western Division C. F. & I. Co.
Townsend, Arthur R. Leadville, Colorado.		Assayer, Union Smelting Co.
Tyler, Sydney B. Parral, Chihuahua, Mexico.		Engineer.
Waltman, Will D. Cripple Creek, Colorado.		Surveyor.
Weiss, Andrew Golden, Colorado.		Instructor in Mathematics and Surveying, Colorado School of Mines.
Williams, Wakely A. Grand Forks, British Columbia.		Ass't. Supt. Granby Cons. M. & M. Co.
	1900.	
Adams, Wilber E. Trinidad, Colorado.		Surveyor, C. F. & I. Co.
Benwell, George A. Idaho Springs, Colorado.		Surveyor.
Bruce, Harry F. Cripple Creek, Colorado.		Surveyor, Hills & Willis.
Crowe, Thomas B. Cripple Creek, Colorado.		Asst. Mgr., Gold Exploration Co.
Drescher, Frank M. Washington Camp, Arizona.		Chemist, Pride of the West Mine.
Evans, Henry R. Surinam, Dutch Guiana, So. America.		Gros Mining Company.

NAME AND ADDRESS.	1900.	OCCUPATION.
Ewing, Charles R. Washington Camp, Arizona.		
Giddings, Donald S. Morenci, Arizona.		Asst. Surveyor, Detroit Copper M. Co.
Harrington, Daniel Sunnyside, Utah.		Surveyor, Pleasant Valley Coal Co.
Jones, Edward B. Scofield, Utah.		Surveyor, Pleasant Valley Coal Co.
Jones, Fred Cripple Creek, Colorado.		Surveyor, John A. Logan Mine.
Lemke, Carl Del Norte, Colorado.		
Malmstrom, C. Clarence Lake City, Colorado.		Assayer and Surveyor, The Hidden Treasure M. & T. Co.
Moynahan, Ambrose E. Alma, Colorado.		Assayer and Surveyor.
Nicolson, George W.		
Pendery, John M. Cripple Creek, Colorado.		Asst. Surveyor, John A. Logan Mine.
Platt, Edwin H. Esther, St. Francis County, Missouri.		Asst. Supt. Columbia Lead Co.
Price, Lyttleton, Jr. Hailey, Idaho.		Mining Engineer
Prout, John Fredericktown, St. Francis County, Mo.		Columbia Lead Co.
Robey, Loyd Villa Park, Colorado.		Surveyor.
Rudd, Arthur H. Ward, Boulder County, Colorado.		
Slater, Amos Silverton, Colorado.		Surveyor, Iowa G. & S. M. Co.
Smith, Claude H. Highland, Utah.		Supt., York Mine.
Steele, James H. Park City, Utah.		
Taylor, Harry Picotte Howard, Crook County, Oregon.		Supt., Mayflower M. & M. Co.
Utley, Howard Harris Redstone, Colorado.		Surveyor, C. F. & I. Co.

Alumni will confer a favor by notifying Prof. Stockton of errors or omissions in the above catalogue, which is known to be incomplete as to residences and occupations.



GYMNASIUM.

GYMNASIUM.

The Gymnasium is the most spacious and the best equipped of any college or school gymnasium in the State, and is a valuable adjunct to the school equipment. It is in the basement of the building of 1890, its floor (65 x 40) admitting drill exercise with ample space for apparatus, while its height of twenty feet allows the use of swinging appliances and perfect ventilation. Around the walls are pulling weights of every description, while among the other instruments are swinging rings, parallel bars, horse buck, quarter circle, "cage" with apparatus for development of every set of muscles, ladders, spring board, complete sets of clubs and dumb-bells and many others.

The Gymnasium is open every school afternoon, also for systematic class work and "free exercise" three evenings of each week. Instruction is given in gymnastic exercises on those evenings. Shower baths (hot or cold) adjoin the gymnasium. Each student pays a fee of five dollars a year, to the Athletic Association and deposits one dollar for his locker key, the latter being returnable.

The Gymnasium is managed by the "School of Mines Athletic Association," composed of officers and students of the institution. The Directors of this Association are responsible to the school for the maintenance of order and care of apparatus.

TEXT BOOKS.

Richter's Inorganic Chemistry.
Prescott and Johnson's Qualitative Analysis.
Cairns' Quantitative Analysis.
Furman's Manual of Assaying.
Wentworth's Higher Algebra.
Chauvenet's Geometry, Byerly's Edition.
Chauvenet's Trigonometry.
Tanner and Allen's Analytical Geometry.
Osborne's Calculus.
Stahl and Wood's Elementary Mechanism.
Low and Bevis' Machine Drawing and Design.
Grant's Gear Wheels.
Church's Descriptive Geometry.
Morris' Geometrical Drawing.
Carhart's University Physics.
Stewart and Gee's Practical Physics.
Balfour Stewart's Principles of Heat.
Thompson's Dynamo Electric Machinery.
Thompson's Electricity and Magnetism.
Bedell and Crehore's Alternating Currents.
Fleming's Alternating Current Transformer.
Thompson's Polyphase Electric Currents.
Hutton's Mechanical Engineering of Power Plants.
Johnson's Engineering Contracts and Specifications.
Johnson's Surveying.
Nagle's Field Manual.
Merriman's Hydraulics.
Ziwet's Theoretical Mechanics.
Greene's Roof and Bridge Trusses.
Baker's Masonry Construction.
Johnson's Theory and Practice of Framed Structures.
Foster's Ore and Stone Mining.
Peters' Copper Smelting.
Eissler's Metallurgy of Silver.
Rose's Metallurgy of Gold.
Hofman's Metallurgy of Lead.
Le Conte's Geology.
Kemp's Handbook of Rocks.
Moses and Parsons' Mineralogy, Crystallography and Blow-Pipe Analysis.
Patton's Lecture Notes on Crystallography.

CONTENTS.